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NATIONAL COMMUNICATIONS FROM PARTIES INCLUDED IN ANNEX I TO THE CONVENTION

GUIDELINES FOR THE PREPARATION OF NATIONAL COMMUNICATIONS

Effects of recalculations of the greenhouse gas inventories of the base and subsequent years on assigned amounts and on emission limitation and reduction commitments of Annex I Parties

Note by the secretariat

CONTENTS

		Paragraphs	Page
I.	INTRODUCTION	1 - 10	2
A.	Mandate	1	2
B.	Background	2 - 3	2
C.	Scope of the note	4 - 5	2
D.	Possible action by the SBSTA	6	3
E.	Approach	7 - 10	3
II.	ASSESSMENT OF THE EFFECTS OF RECALCULATION	11 - 20	4
A.	Effects of recalculations on *simulated* assigned amounts	11 - 16	4
B.	Effects of recalculations on *simulated* commitments by Parties	17 - 20	8
III.	CONCLUSIONS	21 - 23	17

I. INTRODUCTION

A. Mandate

1. The Subsidiary Body for Scientific and Technological Advice (SBSTA), at its eighth session, requested the secretariat to organize a workshop with the participation of methodological experts from the roster, as well as from other relevant organizations, to develop proposals to resolve the methodological issues identified by Parties and by the secretariat while processing greenhouse gas (GHG) inventories included in second national communications (FCCC/SBSTA/1998/6, para. 40 (d)).

B. Background

2. In response to the above mandate, as part of the work programme on methodologies, the secretariat prepared an informal paper: "Effects of recalculations of the GHG inventories of the base and subsequent years on assigned amounts and on emission limitation and reduction commitments of Annex I Parties" for consideration by the experts of the roster attending the workshop on methodological issues. The secretariat prepared this paper to promote an understanding of the possible effects of recalculations of the base and subsequent years' GHG inventories on the assigned amounts and on the emission limitation and reduction commitments of Annex I Parties under the Kyoto Protocol.

3. As requested, the secretariat organized a workshop on methodological issues related to GHG inventories, which was held in Bonn, from 9 to 11 December 1998. This paper, a revised version of the informal paper, considers comments provided by experts from the roster. It is reproduced as an official note prepared by the secretariat.

C. Scope of the note

4. This paper provides information on methodological issues related to the recalculation of GHG inventories for the base and subsequent years. Recalculation of the base year was identified by the secretariat as a relevant methodological issue while processing GHG inventory data (see documents FCCC/SBSTA/1998/7 and FCCC/SBSTA/1998/8).

5. The secretariat used the GHG inventory data from the first national communications, referred to below as NC1 and the second national communications, referred to below as NC2, to prepare this paper.[1]

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[1] Supplementary and updated inventory data submitted to the secretariat after the submission of NC2 were not considered for the purpose of this paper.

D. Possible action by the SBSTA

6. The SBSTA may wish to consider the information provided in this note and to determine the need for additional analyses. It may wish to provide guidance to the secretariat on any future analyses, including the questions it wishes the secretariat to address, such as the consideration of the issue of recalculations in the work programme on methodological issues related to Articles 5, 7 and 8 of the Kyoto Protocol (FCCC/SB/1999/2). For example, it may be interesting to assess the impact of recalculations of the base and subsequent years resulting from the use of different GHG inventory methods/data in second (NC2) and third national communications (NC3) on Parties' assigned amounts and on Parties' ability to meet their commitments. Such an assessment could consider complete sets of five-year inventory data for all Annex I Parties if possible, instead of the limited inventory data used in this note. Such analyses could be reflected in the work programme of the secretariat for the next biennium.

E. Approach

7. The approach applied in this paper assesses the effects of recalculations using actual inventory data reported by Parties. The intent is to assess whether and how changes in methods/data could affect the estimation of assigned amounts and the extent to which Parties could meet *simulated* commitments similar to those in the Kyoto Protocol. It was developed to enable potential methodological problems to be identified before the first commitment period.

8. Terms used in the Kyoto Protocol, such as assigned amounts, commitments and commitment period, were applied in this paper, for years and contexts other than those in the Protocol. The term "*simulated*" is used in the paper to denote this difference. The *simulated* assigned amounts and commitments were used in this paper only with the purpose of identifying potential methodological problems.

9. According to Article 7.4 of the Kyoto Protocol, the Conference of the Parties serving as the meeting of the Parties to the Protocol (COP/MOP) shall decide upon modalities for the accounting of assigned amounts. The term "*simulated* assigned amount" as used in this paper is intended to estimate this assigned amount in a manner similar to that described in Article 3.7 of the Kyoto Protocol, although the COP/MOP has not decided yet upon modalities for accounting.

10. Parties have a commitment under the Kyoto Protocol to limit their GHG emissions to those of an agreed assigned amount. The term "*simulated* commitment" as used in this paper is intended to represent a "what if" situation, wherein the Parties might have agreed to their Kyoto Protocol commitments for the period 1991-1994 relative to a base year of 1990. The related *simulated* assigned amount needed to establish the *simulated* commitment was also estimated for the same period 1991-1994.

II. ASSESSMENT OF THE EFFECTS OF RECALCULATION

A. Effects of recalculations on *simulated* assigned amounts

1. Recalculations

11. All Parties recalculated their GHG inventories between the NC1 and the NC2 (FCCC/SBSTA/1998/7, para. 24). The differences between the estimates were influenced by two factors. First, global warming potential (GWP) values changed between the first national communications and the second national communications. Secondly, Parties changed methods, emission factors, assumptions and activity data and added new sources. These latter changes, which are referred to in this paper as "change in methods/data", are encouraged by the Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories with a view to improving the quality and accuracy of inventories. Table 1 indicates the magnitude of changes for carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) emission base year estimates and their effect on the aggregate CO_2 equivalent emission estimates between NC1s and NC2s.[2]

12. No further changes in GWP values are expected until the end of the first commitment period under the Kyoto Protocol. It should be noted that decision 2/CP.3 of the Conference of the Parties (COP) reaffirmed that Parties should use the 1995 IPCC GWP values based on the effects of the greenhouse gases over a 100-year time horizon (FCCC/CP/1997/7/Add.1). Furthermore, Article 5.3 of the Kyoto Protocol states that this GWP shall be used for the duration of the first commitment period. However, recalculations due to changes in methods/data are expected under the current practice of preparing GHG inventories.

2. Estimation of assigned amounts

13. *Simulated* assigned amounts are presented in this paper. They were estimated in a manner similar to that described in Article 3.7 of the Kyoto Protocol[3] using the following formula:

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[2] This table is reproduced from document FCCC/SBSTA/1998/7, page 31. It gives detailed information on how the table 11 was prepared.

[3] Article 3.7 defines the assigned amount as follows: "In the first ... commitment period, from 2008 to 2012, the assigned amount for each Party included in Annex I shall be equal to the percentage inscribed for it in Annex B of its aggregate anthropogenic carbon dioxide equivalent emissions of the greenhouse gases listed in Annex A in 1990, or the base year or period determined in accordance with paragraph 5 above, multiplied by five. Those Parties included in Annex I for whom land-use change and forestry constituted a net source of greenhouse gas emissions in 1990 shall include in their 1990 emissions base year or period the aggregate anthropogenic carbon dioxide equivalents emissions by sources minus removals by sinks in 1990 from land-use change for the purposes of calculating their assigned amount".

Assigned amount = 5 x [CO_2 equivalent emission estimates of the base year] x [0.01] x [quantified emission limitation or reduction commitment inscribed in Annex B of the Kyoto Protocol][4]

14. The *simulated* assigned amounts were calculated as aggregate GHG emissions expressed as CO_2 equivalent for the base year using data from NC1s and NC2s of Annex I Parties. In both cases, the 1995 IPCC GWP values were used, to exclude the effect of using different GWPs. Therefore, changes in the aggregate GHG emissions in the year 1990, and correspondingly in the *simulated* assigned amounts, between the NC1 and the NC2 are a consequence only of change in methods/data. To carry out the calculations, the secretariat's database was used. Since only eight Parties provided emissions data on hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) in their NC1, these GHGs were not considered for the calculations in this paper for the sake of consistency.

15. A comparison between *simulated* assigned amounts of 28 Parties calculated using data from NC1s and NC2s is shown in table 2. The absolute values of these amounts are presented in columns A and B of the table, differences resulting from changes in methods/data between the NC1 and the NC2 are presented as Gg of aggregate GHG emissions in terms of CO_2 equivalent in column C and as percentages in column D.

16. The percentage differences between those *simulated* assigned amounts mentioned in paragraph 13 above are almost identical[5] to the differences due to changes in methods/data of the aggregate CO_2 equivalent estimates for the year 1990 between the NC1s and the NC2s (see table 1, column F). For Parties with higher or lower CO_2 equivalent estimates in their NC2 than their NC1, their assigned amount was correspondingly higher or lower. So, a change in the given value of the base year has a direct impact on the size of the assigned amount and hence the size of the assigned amount is dependent on changes in methods/data applied to the base year.

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[4] In the light of the ongoing work on methodological issues related to the estimation and reporting of emissions by sources and removals by sinks from the *land-use change and forestry* sector, this report does not provide information on emissions or removals from this sector. Also for this reason, in this report the *simulated* assigned amounts do not consider emissions from the *land-use change and forestry* sector, although Article 3.7 of the Kyoto Protocol stipulates the inclusion of these emissions in the assigned amounts of Parties for whom such emissions constituted a net source of greenhouse gases in 1990.

[5] The differences existing between the values of table 1, column F and those of table 2, column C are a consequence of a slight difference in the way of calculating the effect of change in methods/data and of rounding, except for Estonia and Finland, for which an error was detected in the corresponding calculations of table 11 in document FCCC/SBSTA/1998/7.

Table 1. Differences in GHG emission estimates for the year 1990 due to changes in methods/data used (percentage change)[a]

Party	A	B	C	D	E	F
				All GHG emission estimates (CO_2 equivalent)		
	CO_2 emission estimates	CH_4 emission estimates	N_2O emission estimates	Total change	Effect of the use of different GWPs	Effect of changes in methods/ data
Australia	-5.5	-17.1	31.4	-12.1	-4.4	-7.7
Austria	4.5	-2.6	183.2	3.4	-2.7	6.1
Bulgaria	-0.7	0.8	31.6	-2.6	-4.1	1.5
Canada	<1	3.6	-9.9	-1.9	-2.1	0.2
Czech Republic	<1	-5.8	7.5	-2.2	-1.8	-0.4
Denmark	<1	3.4	230.1	9.7	-2.5	12
Estonia	--	-67.4	-4.2	-2.4	-2.8	0.4
Finland	<1	-2.4	-18.2	-3.8	-1	2.8
France	3.2	4.2	2.8	0.8	-2.4	3.2
Germany	--	--	7.1	-1.4	-1.8	0.4
Greece	3	29.2	26	4.6	-1.7	6.3
Iceland	-1.1	-39.1	-30	-12.2	-2	-10.2
Ireland	--	1.9	-30.6	-10.8	-5.2	-5.6
Italy	<1	-40.3	36.7	-5.5	-1.8	-3.7
Japan	-2.6	14	90.8	-1.3	-0.6	-0.7
Latvia	7.8	17.2	838.8	29	-2.4	31.4
Luxembourg	16.3	0.5	14.5	14.7	-0.7	15.4
Netherlands	--	4.1	-0.6	-1.6	-2.1	0.5
New Zealand	--	-14.1	177.9	-4.5	-7.82	3.32
Norway	<1	49	--	3.9	-3.3	7.2
Portugal	11.8	257.7	33.3	34.1	-4.2	38.3
Russian Federation	<1	-1.9	151.9	-2.6	-3.1	0.5
Slovakia	3	17.9	-21.9	0.8	-2.1	2.9
Spain	<1	1.4	0.3	-2.8	-2.8	0
Sweden	-9.5	-1.5	-39.5	-12.2	-1.9	-10.3
Switzerland	--	-26.7	-26.3	-7.6	-1.8	-5.8
United Kingdom	1.2	-1.5	10.8	-1.1	-2.3	1.2
United States	<1	9.5	3.3	-0.6	-1.9	1.3

[a] Percentage deviation of the inventory of the NC2 relative to the inventory submitted in the NC1. Negative values denote that the later inventory has a lower figure. All figures rounded. Where no value is shown this indicates that the difference is zero between the emissions in the NC1 and the NC2.

Table 2. Comparison between the *simulated* assigned amounts calculated using inventory data of the year 1990 from first and second national communications

	A	B	C	D
Party	***Simulated* assigned amounts for the first commitment period (CO_2 equivalent)**		**Differences between the *simulated* assigned amounts estimated using data from NC1s and NC2s due to change in methods/data[a]**	
			B-A	(C/A)*100
	NC1	**NC2**		
	[Gg]	**[Gg]**	**[Gg]**	**[per cent]**
Austria	336 416	357 944	21 528	6.4
Canada	2 618 351	2 621 942	3 591	0.1
Czech Republic	887 864	883 798	-4 066	-0.5
Denmark	293 319	329 627	36 308	12.4
Estonia	208 490	187 307	-21 183	-10.2
Finland	303 655	296 912	-6 744	-2.2
France	2 217 793	2 291 108	73 315	3.3
Germany	5 514 880	5 536 270	21 390	0.4
Greece	430 330	456 467	26 137	6.1
Iceland	15 626	14 141	-1 485	-9.5
Ireland	278 521	261 561	-16 960	-6.1
Italy	2 521 513	2 447 421	-74 092	-2.9
Japan	5 645 330	5 594 175	-51 155	-0.9
Latvia	124 471	164 077	39 606	31.8
Luxembourg	55 352	63 977	8 625	15.6
Netherlands	946 795	950 369	3 574	0.4
New Zealand	362 415	380 170	17 755	4.9
Norway	233 583	248 793	15 211	6.5
Portugal	230 685	314 833	84 148	36.5
Russian Federation	14 917 480	14 993 835	76 355	0.5
Slovakia	324 415	333 482	9 067	2.8
Spain	1 387 369	1 386 583	-787	-0.1
Sweden	335 234	299 465	-35 770	-10.7
Switzerland	261 639	247 245	-14 393	-5.5
United Kingdom	3 246 386	3 287 579	41 193	1.3
United States	26 279 735	26 566 938	287 203	1.1

[a] Differences in CO_2 equivalent estimates for the year 1990 are only a consequence of change in methods/data. Both estimates were calculated using 1995 GWPs and, therefore, the effect of using different GWPs was excluded. Negative values in the difference denote that the *simulated* assigned amounts calculated using the data of the NC2 are lower than those calculated using the data of the NC1.

B. Effects of recalculations on *simulated* commitments by Parties

17. *Simulated* assigned amounts, using data from NC1s and NC2s were calculated, in line with the Kyoto Protocol. It was assumed that these *simulated* assigned amounts related to the years 1991 to 1994, simply because actual inventory data from the NC1s were available only for this period.[6] To assess the extent to which a Party may go over or under its *simulated* assigned amount, the ratio between total emissions in the *simulated* commitment period and the *simulated* assigned amounts were calculated. This exercise was carried out for data from NC1s and NC2s. Comparisons allow for an assessment of the effects of recalculations of the inventory data owing to changes in methods/data between those national communications.

18. The results of this exercise are presented in table 3. Columns A and B show *simulated* assigned amounts for the *simulated* commitment period of 1991 to 1994,[7] (or 1991 to 1993[8]), expressed as CO_2 equivalent GHG emissions. The year 1990 was used as a base year when calculating the *simulated* assigned amounts. Columns A and B represent the *simulated* assigned amounts based on 1990 data in the NC1 and the NC2 respectively. Actual emission estimates from NC1s and NC2s for the same period are presented in columns C and D. A comparison of actual data with the *simulated* assigned amounts in columns E and F indicates the percentage by which Parties are under or over the *simulated* commitments. The final column shows the difference in these results. It can be observed that in most cases the difference, which reflects changes in methods/data, is lower than one percentage point.[9]

19. On the basis of the data presented in table 3, a number of figures were prepared to facilitate further understanding of effects of the recalculations on the commitments under the Kyoto Protocol. Three figures were prepared for each Party:

(a) The first figure (e.g., 1a) shows the trend of aggregate GHG emissions (CO_2, CH_4, N_2O), expressed in CO_2 equivalent, based on data from the NC1 and the NC2;

(b) The second figure (e.g., 1b) shows in absolute terms the extent by which the Party either goes over or under a *simulated* commitment, given data in either the NC1 or the NC2. It

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[6] Only 13 Parties were selected because they provided complete inventory data in their first national communications for CO_2, CH_4 and N_2O for the years 1991 to 1993/94. Data from the NC1s are used in this paper for analysing methodological problems related to recalculations.

[7] For Canada, Denmark, Estonia, Japan, the Netherlands, New Zealand, Norway, Switzerland, the United Kingdom and the United States of America, which provided inventory data until the year 1994 in their first national communications. The period 1991-1994 is considered as a *simulated* commitment period in this paper. The *simulated* assigned amounts were calculated using the formula of paragraph 6, but using four years instead of five.

[8] France, Germany, Iceland and Japan provided inventory data only until the year 1993 in their first national communications. Thus, the *simulated* commitment period and the *simulated* assigned amounts were calculated for the years 1991 to 1993.

[9] The difference between two percentages is expressed in percentage points. The resulting values can be directly compared to the quantified emission limitation or reduction commitments inscribed in Annex B of the Kyoto Protocol, such as +10 per cent for Iceland and -8 per cent for Switzerland.

shows the amount of CO_2 equivalent emissions by which the total GHG emissions of the *simulated* commitment period were higher (positive value) or lower (negative value) than the *simulated* assigned amounts. The values were calculated by subtracting columns A from C and B from D in table 3.

(c) The third figure (e.g., 1c) shows similar information, but in percentage terms. It represents the values contained in columns E and F of table 3. For example, during the *simulated* commitment period, Canada exceeded its *simulated* assigned amount by 9 per cent according to data in its NC1 (column E in table 3) and by 8.4 per cent according to data in its NC2 (column F in table 3). The percentage over or under this *simulated* commitment was altered by -0.6 percentage points in this case as a consequence of recalculations (column G in table 3).

20. In addition, figures 14 and 15 were prepared to illustrate the understanding of the results presented in table 3 which were obtained using the calculations described in paragraphs 15, 16, 17(b) and 17(c) above.

Table 3. Possible impact of recalculations on *simulated* commitments

Party	A	B	C	D	E	F	G
	***Simulated* assigned amounts for a *simulated* commitment period 1991 to 1994 (1993), (CO_2 equivalent)**		**Total GHG emission estimates for the period 1991 to 1994 (1993), (CO_2 equivalent)**		**Percentage over/under *simulated* commitments**		**Differences between percentages over/under *simulated* commitments[a]**
	NC1	**NC2**	**NC1**	**NC2**	**NC1 100* (C-A)/A**	**NC2 100* (D-B)/B**	**(F-E)**
	[Gg]	**[Gg]**	**[Gg]**	**[Gg]**	**[per cent]**	**[per cent]**	**[percentage points]**
Canada	2 094 681	2 097 554	2 283 421	2 274 230	9	8.4	-0.6
Denmark	234 655	263 701	285 604	321 162	21.7	21.8	0.1
Estonia	166 792	149 846	127 726	119 035	-23.4	-20.6	2.8
France	1 330 676	1 374 665	1 469 644	1 524 409	10.4	10.9	0.5
Germany	3 308 928	3 321 762	3 321 707	3 350 547	0.4	0.9	0.5
Iceland	9 375	8 484	8 485	7 791	-9.5	-8.2	1.3
Japan	3 387 198	3 356 505	3 673 120	3 649 804	8.4	8.7	0.3
Netherlands	757 436	760 295	860 412	858 350	13.6	12.9	-0.7
New Zealand	289 932	304 136	290 704	302 067	0.3	-0.7	-1
Norway	186 866	199 035	183 435	196 809	-1.8	-1.1	0.7
Switzerland	209 311	197 796	226 073	214 140	8.0	8.3	0.3
United Kingdom	2 597 108	2 630 063	2 737 962	2 746 151	5.4	4.4	-1.0
United States	21 023 788	21 253 550	22 867 165	23 218 753	8.8	9.2	0.4

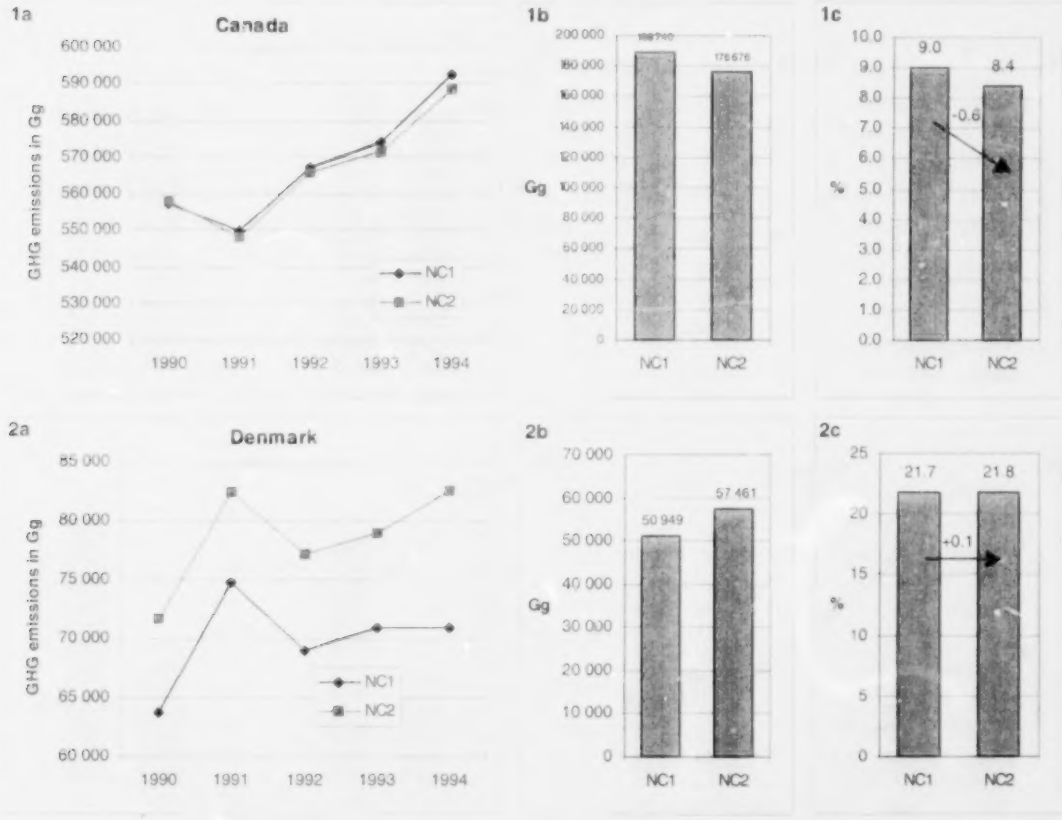
[a] The value was calculated by subtracting the values of column F (percentage over/under *simulated* commitments calculated using data from NC2) from column E (percentage over/under *simulated* commitments calculated using data from NC1). The difference between two percentages is expressed in percentage points. The resulting values can be directly compared to the quantified emission limitation or reduction commitments inscribed in Annex B of the Kyoto Protocol, such as +10 per cent for Iceland and -8 per cent for Switzerland.

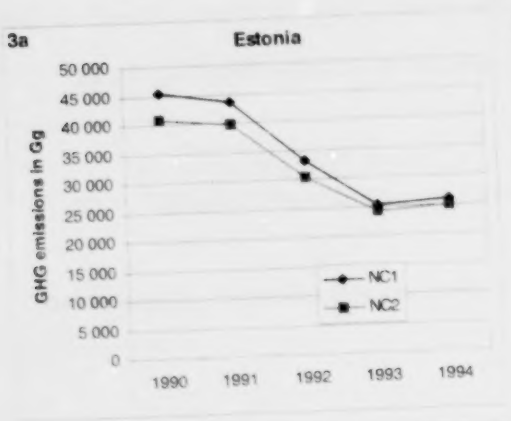
FIGURES

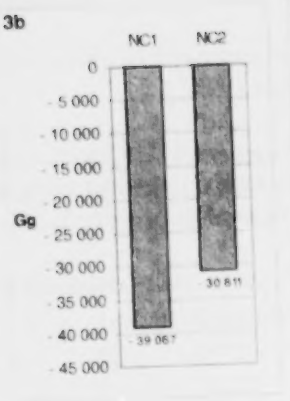
Figures a - Trends in aggregate GHG emissions expressed in CO_2 equivalent (Gg) for the years 1990 to 1994.

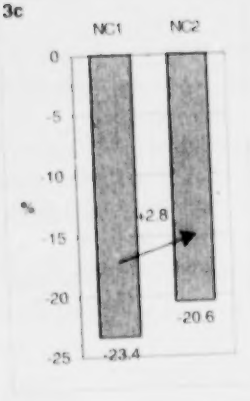
Figures b - Amount of aggregate GHG emissions by which the Party either over- or under-achieved its *simulated* commitment, given data in either the NC1 or the NC2 (CO_2 equivalent in Gg).

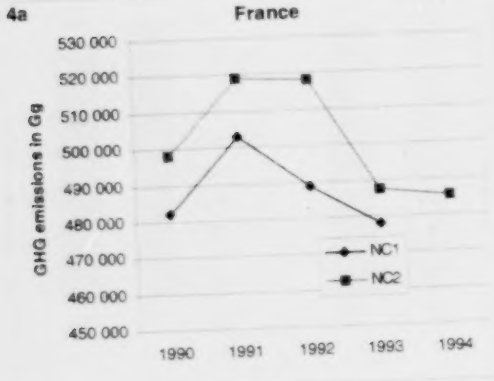
Figures c - Percentage over or under *simulated* commitments and differences between these levels (in percentage points).

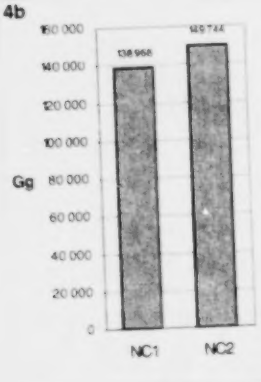


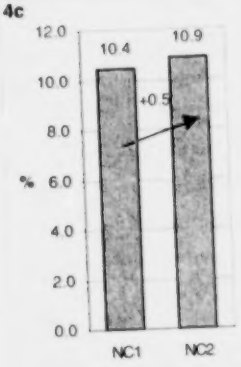

3a
Estonia
GHG emissions in Gg
50 000
45 000
40 000
35 000
30 000
25 000
20 000
15 000
10 000
5 000
0
1990
1991
1992
1993
1994
NC1
NC2

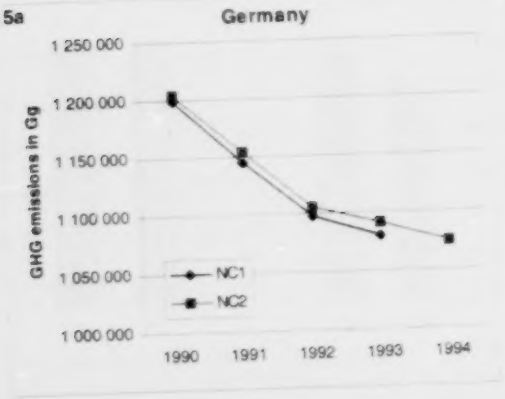

3b
NC1
NC2
Gg
0
- 5 000
- 10 000
- 15 000
- 20 000
- 25 000
- 30 000
- 35 000
- 40 000
- 45 000
- 39 067
- 30 811

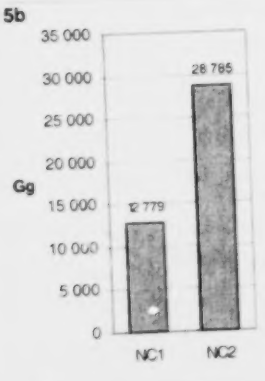

3c
NC1
NC2
%
0
-5
-10
-15
-20
-25
+2.8
-23.4
-20.6

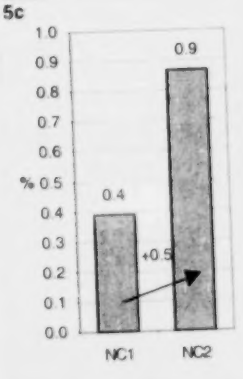

4a
France
GHG emissions in Gg
530 000
520 000
510 000
500 000
490 000
480 000
470 000
460 000
450 000
1990
1991
1992
1993
1994
NC1
NC2

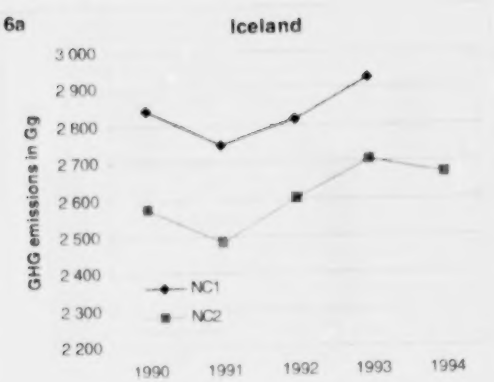

4b
Gg
160 000
140 000
120 000
100 000
80 000
60 000
40 000
20 000
0
138 968
NC1
NC2

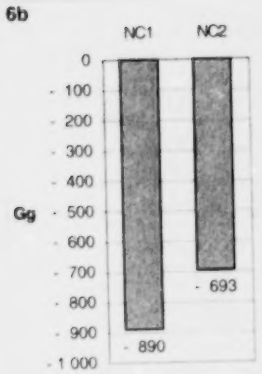

4c
%
12.0
10.0
8.0
6.0
4.0
2.0
0.0
10.4
10.9
+0.5
NC1
NC2

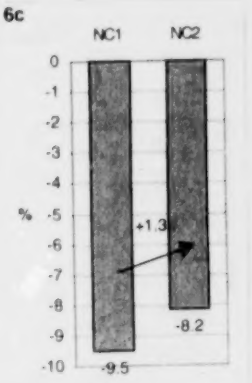

5a
Germany
GHG emissions in Gg
1 250 000
1 200 000
1 150 000
1 100 000
1 050 000
1 000 000
1990
1991
1992
1993
1994
NC1
NC2

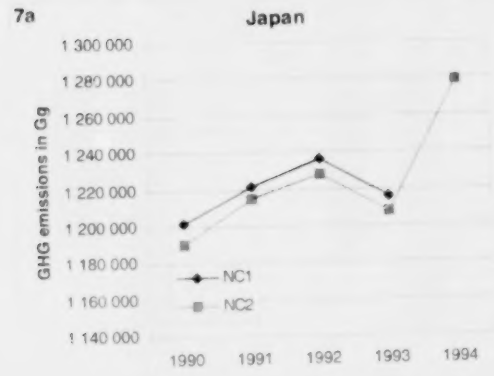

5b
Gg
35 000
30 000
25 000
20 000
15 000
10 000
5 000
0
12 779
28 785
NC1
NC2

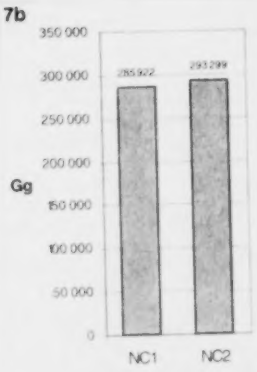

5c
%
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.4
0.9
+0.5
NC1
NC2

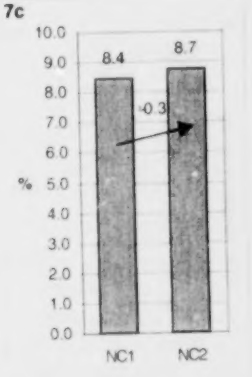

6a
Iceland
GHG emissions in Gg
3 000
2 900
2 800
2 700
2 600
2 500
2 400
2 300
2 200
NC1
NC2
1990
1991
1992
1993
1994


6b
NC1
NC2
Gg
0
- 100
- 200
- 300
- 400
- 500
- 600
- 700
- 800
- 900
- 1 000
- 890
- 693

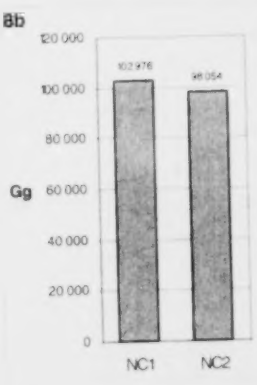

6c
NC1
NC2
%
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
+1.3
-8.2
-9.5

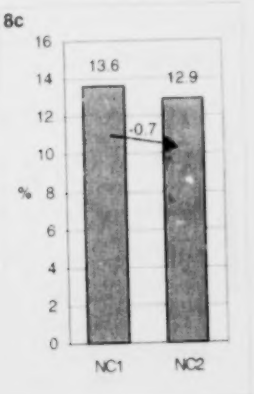

7a
Japan
GHG emissions in Gg
1 300 000
1 280 000
1 260 000
1 240 000
1 220 000
1 200 000
1 180 000
1 160 000
1 140 000
NC1
NC2
1990
1991
1992
1993
1994

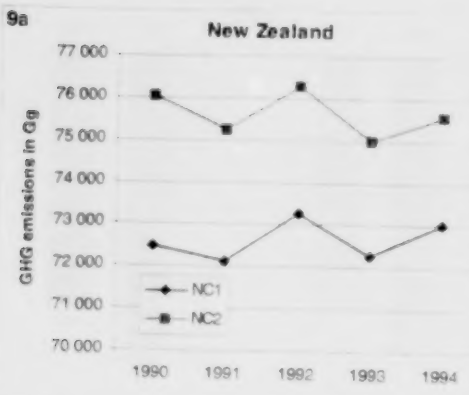

7b
Gg
350 000
300 000
250 000
200 000
150 000
100 000
50 000
0
285 922
293 299
NC1
NC2

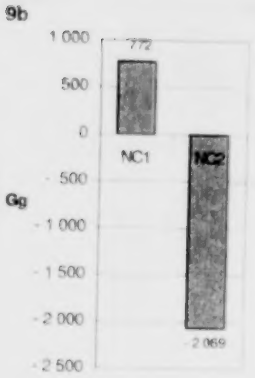

7c
%
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
8.4
8.7
-0.3
NC1
NC2

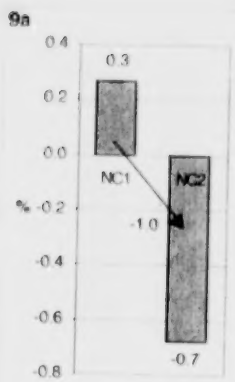
8a
The Netherlands
GHG emissions in Gg
220 000
218 000
216 000
214 000
212 000
210 000
208 000
206 000
204 000
202 000
200 000
198 000
NC1
NC2
1990
1991
1992
1993
1994

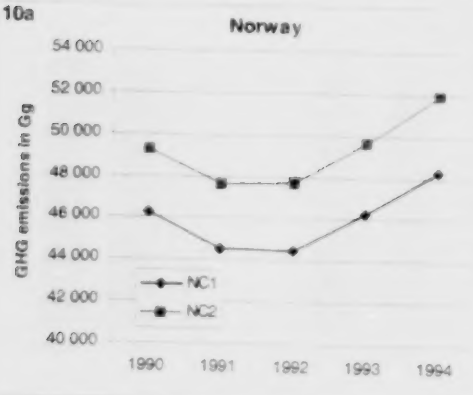

8b
Gg
120 000
100 000
80 000
60 000
40 000
20 000
0
102 976
98 054
NC1
NC2

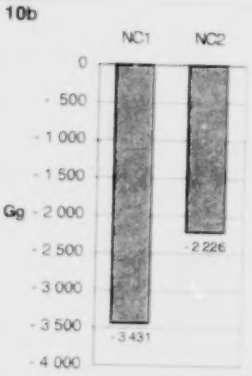

8c
%
16
14
12
10
8
6
4
2
0
13.6
12.9
-0.7
NC1
NC2

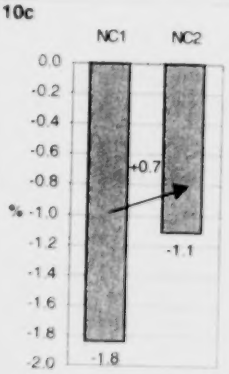

9a
New Zealand
GHG emissions in Gg
77 000
76 000
75 000
74 000
73 000
72 000
71 000
70 000
NC1
NC2
1990
1991
1992
1993
1994

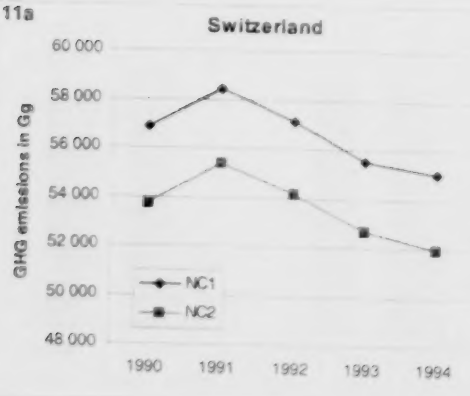

9b
1 000
500
0
- 500
- 1 000
- 1 500
- 2 000
- 2 500
Gg
772
NC1
NC2
- 2 069

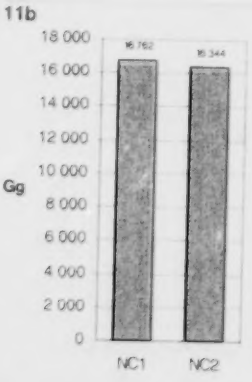

9a
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
%
0.3
NC1
NC2
-1.0
-0.7

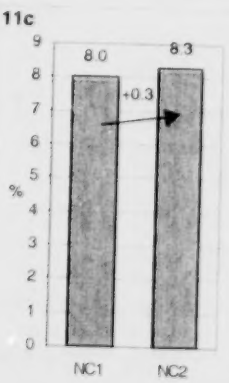

10a
Norway
GHG emissions in Gg
54 000
52 000
50 000
48 000
46 000
44 000
42 000
40 000
NC1
NC2
1990
1991
1992
1993
1994


10b
NC1
NC2
0
- 500
- 1 000
- 1 500
- 2 000
- 2 500
- 3 000
- 3 500
- 4 000
Gg
- 3 431
- 2 226

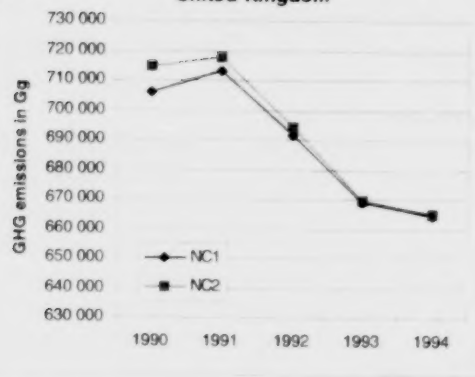

10c
NC1
NC2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4
-1.6
-1.8
-2.0
%
+0.7
-1.1
-1.8


11a
Switzerland
GHG emissions in Gg
60 000
58 000
56 000
54 000
52 000
50 000
48 000
NC1
NC2
1990
1991
1992
1993
1994


11b
18 000
16 000
14 000
12 000
10 000
8 000
6 000
4 000
2 000
0
Gg
NC1
NC2


11c
9
8
7
6
5
4
3
2
1
0
%
8.0
8.3
+0.3
NC1
NC2

12a



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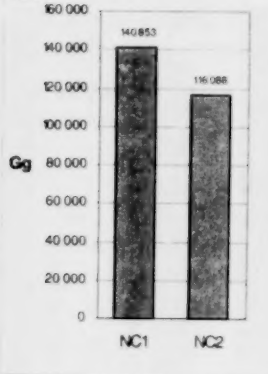

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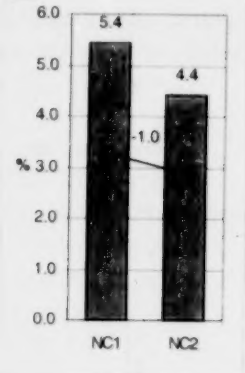
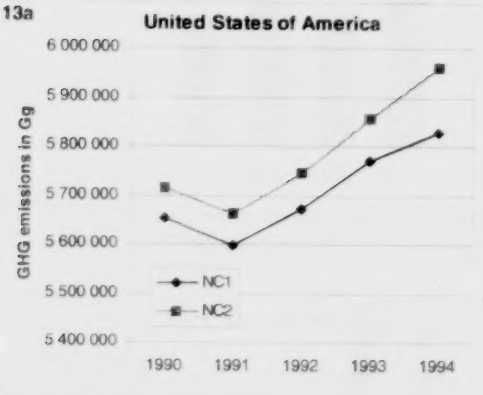
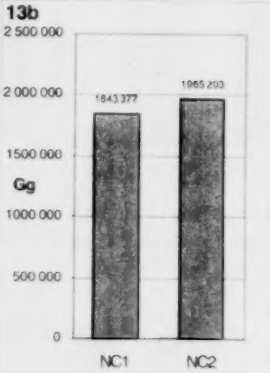


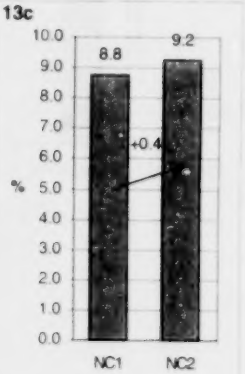
13a



13b



13c



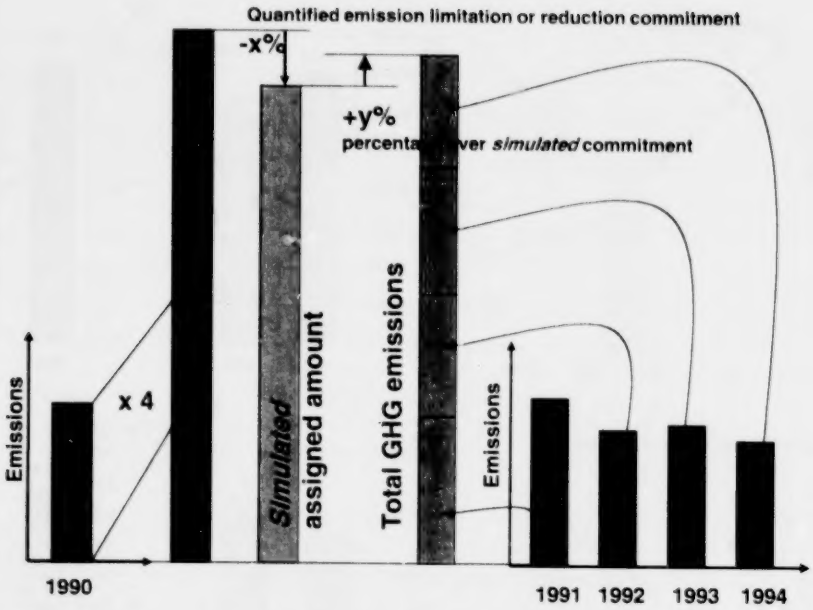


Figure 14: Illustration of the calculation of the *simulated* assigned amount and of the percentage by which Parties are under or over the *simulated* commitments.

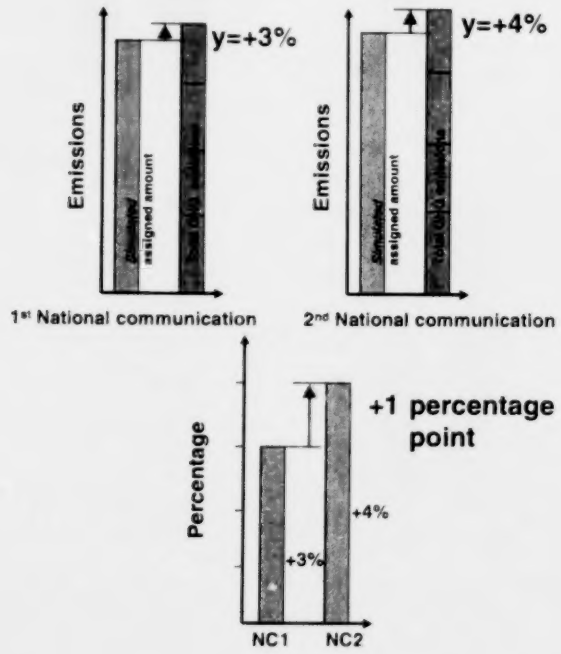


Figure 15: Illustration of the difference by which Parties are under or over the *simulated* commitments as a consequence of using data from the NC1 and the NC2

III. CONCLUSIONS

21. Base year inventory data can change significantly as a result of recalculations due to new methods/data. Since the assigned amounts under the Kyoto Protocol in mass units are calculated using base year inventory data, these too can change significantly.

22. For thirteen Parties, a *simulated* assigned amount for a *simulated* commitment period was estimated using 1990 inventory data in NC1s and as recalculated in NC2s. The assigned amounts were then compared to the actual inventory data for the period 1991-1994 as reported in NC1s and NC2s. Furthermore, the extent by which Parties either go over or under *simulated* commitments for this *simulated* commitment period was estimated in relative terms to the assigned amounts.[10] The results indicate that for thirteen Parties, changes in methods would cause these Parties to go over or under their *simulated* commitments by +2.9 to -1.0 additional percentage points.

23. The results seem to indicate that the absolute changes in assigned amounts used in the assessment of Parties' commitments may be significant, given a change in methods/data in the inventory. The overall effect of changes in methods, if applied consistently to emission estimates during a commitment period, may be less significant. Nevertheless, such changes in methods may need to be considered by Parties, as even small changes may affect a Party's ability to meet its commitments.

- - - - -

[10] These values can be directly compared to the quantified emission limitation or reduction commitments inscribed in Annex B of the Kyoto Protocol, such as +10 per cent for Iceland and -8 per cent for Switzerland.

UNITED NATIONS

Framework Convention on Climate Change

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12 May 1999

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Tenth session
Bonn, 31 May -11 June 1998
Item 5 (b) of the provisional agenda

METHODOLOGICAL ISSUES

EMISSIONS RESULTING FROM FUEL USED FOR INTERNATIONAL TRANSPORTATION

Note by the secretariat

CONTENTS

		Paragraphs	Page
I.	INTRODUCTION	1 - 4	3
A.	Mandate	1	3
B.	Scope of the note	2 - 3	3
C.	Possible action by the SBSTA	4	3
II.	BACKGROUND INFORMATION	5 - 16	4
A.	Previous intergovernmental considerations	5 - 9	4
B.	Definition of international bunker fuels	10 - 12	5
C.	Gases emitted from the use of bunker fuels	13 - 16	6

		Paragraphs	Pa
III.	CURRENT INTERNATIONAL WORK	17 - 24	6
	A. Intergovernmental Panel on Climate Change (IPCC) ..	17 - 20	6
	B. International Civil Aviation Organization (ICAO)	21 - 23	7
	C. International Maritime Organization (IMO)	24	7
IV.	CURRENT REPORTING IN NATIONAL COMMUNICATIONS AND ANNUAL INVENTORY REPORTS	25 - 34	8
	A. Emission estimates reported by Parties	26 - 28	8
	B. Methods and data used by Parties to estimate emissions from international bunker fuels	29 - 34	9

I. INTRODUCTION

A. Mandate

1. The Subsidiary Body for Scientific and Technological Advice (SBSTA), at its ninth session, requested the secretariat to provide information to the SBSTA, at its tenth session, on emissions resulting from fuel sold to ships or aircraft engaged in international transport, taking into account the ongoing work of the International Maritime Organization (IMO) and the International Civil Aviation Organization (ICAO). It took note of the information provided by ICAO and requested the secretariat to invite representatives of ICAO and IMO to report on their work to the SBSTA at its tenth session (FCCC/SBSTA/1998/9, para. 51 (i)).

B. Scope of the note

2. This note has been prepared in response to the above mandate. It contains background information on previous intergovernmental considerations, the definition of international bunker fuels and on gases emitted from use of international bunker fuels. It considers information provided by international organizations, particularly the Intergovernmental Panel on Climate Change (IPCC), ICAO and IMO. Finally, it provides information on the current reporting of Parties in national communications and annual inventory reports. The data in this note provide a factual basis for further considerations.

3. Other documents containing information related to emissions from international bunker fuels are documents FCCC/SBSTA/1996/9/Add.1 on methodological issues and FCCC/SBSTA/1996/9/Add.2 containing detailed information on electricity trade and international bunker fuels. In addition, Parties may consider the IPCC Special Report on Aviation and the Global Atmosphere, which is to be made available at the tenth session of the SBSTA.

C. Possible action by the SBSTA

4. The SBSTA may wish to consider the information in this note to develop an approach for further elaborating on decision 2/CP.3 (FCCC/CP/1997/7/Add.1) and Article 2.2 of the Kyoto Protocol, to identify additional information needed and to provide guidance on the content and timing of preparatory work needed for future sessions, taking into account the work of IPCC, ICAO and IMO.

II. BACKGROUND INFORMATION

A. Previous intergovernmental considerations

5. The Revised Guidelines for the Preparation of National Communications by Parti included in Annex I to the Convention as adopted by the Conference of the Parties state t "in providing information on emissions from international aviation and marine bunker fu in accordance with the IPCC Guidelines for National Greenhouse Gas Inventories, Partie include such data, in a separate category, in their inventories of emissions on the basis of sold and should, as far as possible, not include them in total national emissions" (FCCC/CP/1996/15/Add.1, annex to decision 9/CP.2, para. 17).

6. The SBSTA elaborated on the issue of international bunker fuels at its fourth sess "noted that there are three separate issues related to international bunker fuels: adequate consistent inventories, allocation of emissions and control options. Appropriate allocatio responsibility for emissions from international bunker fuels would be connected to inven control issues. The SBSTA noted that eight options for allocation of bunker fuels were suggested in document FCCC/SBSTA/1996/9/Add.1, and considered that options 1, 3, 4, should be the basis for its further work on the issue. With respect to option 1, it should b considered to recognize the responsibilities of the international community to address iss related to international bunker fuels. The SBSTA took note of the work of the Internatio Aviation Organization (ICAO), as well as the work of the Annex I expert group on polici measures to address these emissions. The SBSTA noted the role of ICAO and the Interna Maritime Organization (IMO) in addressing the control of international bunker fuel emis and the opportunity for Parties to work through these bodies. The SBSTA encouraged Pa report emissions from international aviation and marine bunker fuels as two separate entr their national communications, in accordance with the revised 1996 IPCC guidelines" (FCCC/SBSTA/1996/20, para. 55).

7. Since the fourth session of the SBSTA, the adoption of the Kyoto Protocol introd new elements that may affect further consideration of the issue of bunker fuels. These in the concept of a differentiated commitment based on assigned amounts for a particular pe the introduction of different base years, for example for HFCs, PFCs and SF_6, and the pro of mechanisms such as emissions trading.

8. In particular, Article 2.2 of the Kyoto Protocol states that "the Parties included in shall pursue limitation or reduction of emissions of greenhouse gases not controlled by th Montreal Protocol from aviation and marine bunker fuels, working through the Internatio Civil Aviation Organization and the International Maritime Organization, respectively."

9. In addition, the Conference of the Parties (COP), in its decision 2/CP.3, recalled t under the Revised 1996 Guidelines for National Greenhouse Gas Inventories of the Intergovernmental Panel on Climate Change, emissions based upon fuel sold to ships or

engaged in international transport should not be included in national totals, but reported separately; and urged the Subsidiary Body for Scientific and Technological Advice to further elaborate on the inclusion of these emissions in the overall greenhouse gas inventories of Parties (FCCC/CP/1997/7/Add.1).[1]

B. Definition of international bunker fuels

10. The term "international bunker fuels" refers in this paper to fuels used for international civil aviation or by seagoing ships engaged in international transport. The Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, referred to below as "the IPCC Guidelines", provide separate categories for emissions from international bunker fuels from the aviation and marine sectors.[2] These categories do not include international road transport. Emissions from international road transport are not reported in a separate category and, hence, are allocated to the Party where fuel is sold. Furthermore, it may be noted that the terms "international bunkers", "bunker fuels", or "bunkers" historically refer to marine fuels, but in the context of greenhouse gas inventories are generally used to denote the international share of fuel sold to ships and aircraft.

11. According to the IPCC Guidelines, emissions from these fuels should be estimated on the basis of fuels *sold*, that is, fuel taken on board by each departing aircraft or vessel. It should be distinct from emissions resulting from fuel *consumed* during a journey. The fuel intake of an aircraft, for example, does not necessarily take place in the country of departure. Since carrying excess fuel increases the weight of the aircraft and hence the amount of fuel required to reach the next airport, aircraft on long-haul flights usually only take on the amount of fuel required to reach the next airport. On shorter flights, aircraft may carry sufficient fuel for several stops, depending upon fuel prices, availability and other considerations.

12. Furthermore, complex relationships may exist in the shipping as well as in the aviation sector. These may affect data on fuel use. A ship, for example, may be owned by a company in one country, which itself is owned by other companies in another country, registered in a third country, operated by a ship-management company in a fourth country and crewed from a manning agency in a fifth country with nationals from other countries. Furthermore, carriage may be paid for by charterers, and in some cases a number of sub-charterers, based in other countries.

---

[1] It would be up to the Parties to determine whether, and if so when, the inclusion of international bunker fuels into national totals would affect "assigned amounts" as defined in Article 3 of the Kyoto Protocol. If emissions from international bunker fuels were included in the base year and the "assigned amounts" of Parties, and if bunker emissions were to increase faster or decrease slower than the emissions from other sources, it would make it more difficult for Parties to meet their commitment under the Kyoto Protocol. Conversely, if bunker emissions were to increase slower or decrease faster than the emissions from other sources, it would make it easier for Parties to meet their commitment under the Kyoto Protocol.

[2] IPCC source category 1A3a-i for international aviation bunkers and 1A3d-i for international marine bunkers.

C. Gases emitted from the use of bunker fuels

13. "Aircraft emit gases and particles directly into the upper troposphere and lower stratosphere where they have an impact on atmospheric composition. These gases and parti alter the concentration of atmospheric greenhouse gases, including carbon dioxide (CO_2), oz (O_3) and methane (CH_4); trigger formation of condensation trails (contrails); and may increa cirrus cloudiness - all of which contribute to climate change."[3]

14. "The principal emissions of aircraft include the greenhouse gases carbon dioxide an water vapor (H_2O). Other major emissions are nitric oxide (NO) and nitrogen dioxide (NO_2 (which together are termed NO_x), sulfur oxides (SO_x), and soot. The total amount of aviatio fuel burned, as well as the total emissions of carbon dioxide, NO_x, and water vapor by aircr are well known relative to other parameters important to this assessment."

15. The gases emitted from shipping include carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), as well as carbon monoxide (CO), nitrogen oxides (NQ), non-methane volatile organic compounds (NMVOCs) and sulphur oxides (SO_x). CO_2 is the major contri while the global warming impact imposed by NO_x from shipping is considered to be small.

16. For additional information regarding the aviation and maritime sector, please refer t document FCCC/SBSTA/1996/9/Add.2.

III. CURRENT INTERNATIONAL WORK

A. Intergovernmental Panel on Climate Change (IPCC)

17. The IPCC Special Report on Aviation and the Global Atmosphere provides an assessment of the effects of aircraft on the climate and atmospheric ozone. It contains information on the impact and projected growth of emissions as well as options to limit or r them. The following paragraphs present some of its findings.

18. "The best estimate of the radiative forcing in 1992 by aircraft is 0.05 Wm^{-2} or about per cent of the total radiative forcing by all anthropogenic activities. For the reference scen (Fa1), the radiative forcing by aircraft in 2050 is 0.19 Wm^{-2} or 5 per cent of the radiative fo in the mid-range IS92a scenario (3.8 times the value in 1992)."

19. While the effects of CO_2 emissions from aircraft are indistinguishable from the sam quantity of CO_2 emitted by any other source, other emissions from aircraft have a greater ef on the climate due to emissions at high altitudes. "Over the period from 1992 to 2050, the overall radiative forcing by aircraft (excluding that from change of cirrus clouds) for all sce

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[3] See IPCC Special Report on Aviation and the Global Atmosphere. Quotations in paragraphs 14, 18 and from the same source.

of this report is a factor 2 to 4 larger than the forcing by aircraft carbon dioxide alone. The overall radiative forcing for the sum of all human activities is estimated to be at most a factor of 1.5 larger than that of carbon dioxide alone."

20. The information provided on options to reduce emissions and impacts includes aircraft and engine technology options, fuel options, operational options, and regulatory and economic options, which consist of engine emissions certification, market-based options such as environmental levies (charges and taxes) and emissions trading, as well as voluntary agreements.

B. International Civil Aviation Organization (ICAO)

21. The 32nd session of the ICAO Assembly (22 September to 2 October 1998) underlined the importance of the Kyoto Protocol and, in a resolution, requested the Council of ICAO to study policy options to limit or reduce the greenhouse gas emissions from civil aviation, taking into account the findings of the IPCC Special Report on Aviation and the Global Atmosphere and the requirements of the Kyoto Protocol, and to report to the next ordinary session of the Assembly in September/October 2001.

22. The work of ICAO related to greenhouse gas emissions falls into three categories: technology and standards, including improved engine or airframe design; operational measures, such as more direct routings through satellite-based communication, navigation, surveillance and air traffic management (CNS/ATM) systems; and market-based options such as emission-related levies (charges or taxes) and emissions trading.

23. Further, the ICAO Assembly considered how ICAO might be able to contribute to an elaboration on decision 2/CP.3. It agreed on the need for continued co-operation with the secretariat of the UNFCCC on this issue, and endorsed further immediate work by ICAO on the effects of the various options that have been suggested by the SBSTA. Such activities would be in close liaison with SBSTA to make proposals for a suitable methodology for allocation.

C. International Maritime Organization (IMO)

24. The Marine Environment Protection Committee (MEPC) of IMO, at its 42nd session (2 to 6 November 1998), agreed to invite the secretariat of IMO to undertake a study concerning greenhouse gas emissions from ships. It will include the current status of greenhouse gas emissions from ships, as well as short- and long-term measures for the reduction of emissions. The report will be available for the 44th session of the MEPC in March 2000. The outcome of the study will form the basis for the MEPC's considerations and development of a policy document on greenhouse gas emissions from ships, which should be forwarded to the secretariat of the UNFCCC.

IV. CURRENT REPORTING IN NATIONAL COMMUNICATIONS AND ANNUAL INVENTORY REPORTS

25. This section provides the estimates of international bunker fuel emissions of Parties on the basis of the latest inventory submissions to the secretariat at the date of preparation of this document. Information from either annual inventory reports or, where not available, second national communications was used. It also includes a preliminary analysis of the methods and data used by Parties for the estimation of these emissions.

A. Emission estimates reported by Parties

26. For the 25 Annex I Parties which reported CO_2 emissions from international bunker fuels for 1990 separately, these emissions account for 2.5 per cent and 2.7 per cent of their total CO_2 emissions[4] in 1990 and 1994 respectively. For the 19 Annex I Parties which reported CO_2 emissions from the marine and aviation sectors separately, emissions from international aviation bunkers accounted for 1.2 per cent, and emissions from international marine bunkers for 1.9 per cent of total CO_2 emissions.

27. Of the 25 Parties that reported CO_2 emissions from international bunker fuels separately, international bunker fuel emissions increased from 1990 to the last year reported (1994, 1995, 1996, or 1997) for 22 Parties. An increase of over 50 per cent was reported by four Parties. The share of CO_2 emissions from international bunker fuels in relation to total national CO_2 emissions (excluding emissions from land-use change and forestry) of individual Parties in 1990 generally ranged around 5 per cent and for some Parties up to 25 per cent. From 1990 to the last year reported (1994, 1995, 1996, or 1997), this share increased for 18 Parties and decreased for seven Parties. Hence, under the assumption that these emissions were to be included in national totals, this inclusion would affect the trend in CO_2 emissions upwards, for 18 Parties, by an average of 0.7 percentage points, and downwards, for seven Parties, by an average of -0.4 percentage points. The effect on the trend is small for those Parties whose emissions from international bunker fuels are small and/or whose trend of international bunker fuel emissions is similar to that of total emissions.

28. Table 1 shows the number of Parties which reported emissions from international bunker fuels separately. The total number of Annex I Parties considered is 37. The two Parties which reported that these emissions are negligible were not included in counting the reporting Parties. Table 2 presents the CO_2 emissions from international bunker fuels, 1990-1997, in gigagrams and percentage of 1990 levels. Tables 3 and 4 present the emissions of CO_2, CH_4, N_2O, CO, NO_x, NMVOCs and SO_2 from international bunker fuels, 1990. Table 5 presents the percentage share of CO_2 emissions from international bunker fuels in relation to total national CO_2 emissions (excluding land-use change and forestry). Table 7 shows the trend in total CO_2

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[4] Total CO_2 emissions exclude emissions from international bunker fuels.

emissions and the trend including international bunker fuels, as a percentage of the respective 1990 levels, as well as the difference in these trends for the last reported year in percentage points, all estimates excluding land-use change and forestry.

Table 1. Number of Parties which reported emissions from international bunker fuels separately for 1990[5]

Gas	Emissions from international bunker fuels		Aviation and marine separate	
	Number of Parties	Percentage	Number of Parties	Percentage
CO_2	25	68	19	51
CH_4	21	57	16	43
N_2O	20	54	14	38
CO	18	49	14	38
NO_x	19	51	14	38
NMVOCs	18	49	14	38
SO_2	10	27	8	22

B. Methods and data used by Parties to estimate emissions from international bunker fuels

29. This section presents the findings of a study undertaken by the secretariat, with the assistance of a consultant, to identify and assess the procedures for data collection, methods used to estimate emissions, and barriers which prevent consistent reporting.

30. The preliminary analysis suggests that the major barriers to reporting emissions from international bunker fuels consistently include: availability of data to make the required split between domestic and international; consistent use of definitions of domestic and international; and consistent use of methods to estimate the emissions.

31. For some Parties, the distinction between domestic and international is not given in national energy statistics. Hence, several Parties were not in a position to report emissions from international bunker fuels separately (tables 1 and 2) or employed different definitions regarding the international share of emissions from ships and aircraft.

32. For example, Hungary and Ireland consider all emissions from fuel sold to ships and aircraft as international. Further, Norway reports difficulties in isolating domestic from international data for airline companies with extensive national and international traffic via other

[5] The total number of Annex I Parties considered is 37. The two Parties which reported that these emissions are negligible, were not included in counting the reporting Parties. Parties which are landlocked nations and do not have marine bunkers were included in counting the Parties that reported aviation and marine separately.

Nordic countries. Germany assumes 20 per cent of the air traffic to be domestic and is currently undertaking a research project to corroborate this assumption. Canada considers all emissions which are based on fuel sold to foreign registered vessels and aircraft as international. Other Parties report difficulties in reporting these emissions separately.

33. The implications of the use of different definitions in terms of emissions is difficult to estimate with the data available at present. The split between domestic and international emissions for reporting Parties may give an indication of the implications of the use of different definitions. Table 6 presents domestic and international CO_2 emissions from transport and the share of each in 1990 for selected Parties which reported international emissions separately and emissions of domestic transport in sufficient detail. The limited data suggest that for countries with a small area, the domestic share of the emissions is rather low (Belgium) whereas in countries with a large area, the domestic share is rather high (Canada).

34. The data currently collected by some Parties is based on fuel sold to ships and aircraft engaged in international transport, as required by the IPCC Guidelines. Some Parties also collect data on the amount of fuel sold to foreign registered companies. Additional data which could be relevant include the amount of fuel sold to foreign registered transport companies, aircraft, ships or operators, and countries of departure and destination for all journeys of all ships and aircraft and of all passengers and cargo engaged in international transport. These data could be derived from global flight schedules, which are limited to scheduled flights, or global sales databases for marine fuels. These sources of data are currently not available to the secretariat. If these data are not available elsewhere, it might take Parties three to five years to put in place systems to collect and report such information in a consistent manner. The cost of additional data collection cannot be determined by the secretariat. If Parties were to collect such data, the reporting format for these emissions and the guidelines for the preparation of national communications (including part I of the reporting guidelines on inventories) would possibly need further modifications.

Table 2. CO_2 emissions from international bunker fuels, 1990-1997 (Gigagrams and percentage relative to 1990, 1990=100)

	1990 (Gg)	1991 (Gg)	(%)	1992 (Gg)	(%)	1993 (Gg)	(%)	1994 (Gg)	(%)	1995 (Gg)	(%)	1996 (Gg)	(%)	1997 (Gg)	(%)
Australia	6 401	6 379	**100**	6 584	**103**	6 988	**109**	7 240	**113**	8 533	**133**	9 031	**141**		
Austria[a]	890	1 040	**117**	1 110	**125**	1 080	**121**	1 140	**128**	1 220	**137**	1 380	**155**		
Belgium	15 726	15 980	**102**	16 738	**106**	16 770	**107**	16 021	**102**	15 556	**99**	18 308	**116**		
Bulgaria[b]	162	878	**541**	873	**538**	844	**520**	850	**523**	882	**543**				
Canada	4 920	4 610	**94**	4 640	**94**	4 290	**87**	4 540	**92**	4 710	**96**	5 170	**105**		
Czech Republic												459			
Denmark	4 986	4 507	**90**	4 677	**94**	6 041	**121**	6 736	**135**	7 080	**142**	6 970	**140**		
Estonia[c]															
Finland	2 800			3 000	**107**	2 500	**89**	2 120	**76**	1 800	**64**	2 100	**75**	2 300	**82**
France	15 488	15 846	**102**	16 827	**109**	17 037	**110**	16 639	**107**	17 329	**112**	18 154	**117**		
Germany	19 569	18 102	**93**	17 818	**91**	19 917	**102**	19 874	**102**	19 874	**102**	19 874	**102**		
Greece	10 423	9 446	**91**	10 610	**102**	12 711	**122**	13 203	**127**	13 812	**133**	12 432	**119**		
Hungary[a,d]		376	**100**	386	**103**	361	**96**	532	**141**	524	**139**	560	**149**		
Iceland	319	260	**82**	264	**83**	293	**92**	307	**96**	377	**118**				
Ireland	1 172	1 316	**112**	1 124	**96**	1 546	**132**	1 350	**115**	1 510	**129**	1 605	**137**		
Italy	12 204							12 416	**102**	13 099	**107**				
Japan	30 806	33 036	**107**	34 095	**111**	36 688	**119**	37 494	**122**	37 328	**121**	32 420	**105**		
Latvia[c]															
Liechtenstein[c]															
Lithuania[c]															
Luxembourg[a]	111							194	**175**	194	**175**				
Monaco[e]															
Netherlands	40 400	41 700	**103**	42 700	**106**	44 600	**110**	43 200	**107**	44 600	**110**	45 800	**113**		
New Zealand	2 384	2 205	**92**	2 189	**92**	2 256	**95**	2 768	**116**	2 708	**114**	2 580	**108**		
Norway	1 988	1 786	**90**	2 130	**107**	2 334	**117**	2 402	**121**	2 828	**142**	3 112	**157**		
Poland												2 068			
Portugal	2 062	2 068	**100**	2 133	**103**	1 848	**90**	1 850	**90**						
Romania[c]															
Russian Federation	12 400							10 000	**81**						
Slovakia[c]															
Slovenia[c]															
Spain[f]	18 024	18 824	**104**	19 496	**108**	17 875	**99**	19 144	**106**						
Sweden	4 207	4 331	**103**	4 816	**114**	4 855	**115**	5 400	**128**	5 367	**128**	4 899	**116**		
Switzerland[a]	2 160	2 200	**102**	2 240	**104**	2 290	**106**	2 330	**108**	2 430	**113**	2 500	**116**		
Ukraine[c]															
United Kingdom	21 349	20 909	**98**	22 761	**107**	23 814	**112**	24 243	**114**	26 086	**122**	28 163	**132**		
United States	83 400	87 800	**105**	91 300	**109**	83 800	**100**	81 700	**98**	86 700	**104**	82 400	**99**		

[a] Party is landlocked and does not have marine bunkers.
[b] 1990 column contains values for 1988, the base year for Bulgaria. The percentages are related to the base year 1988.
[c] Party did not provide estimates for international bunker fuels.
[d] Party did not provide estimate for 1990. The percentages are related to the year 1991.
[e] Party did not provide estimates for international bunker fuels, but indicated that emissions were negligible.
[f] Party did not provide estimates for international bunker fuels in 1998 inventory submission. Values are taken from second national communication.

Table 3. Emissions of CO_2, CH_4 and N_2O from international bunker fuels, 1990 (Gigagrams)

	CO_2			CH_4			N_2O		
	Aviation (Gg)	Marine (Gg)	Total (Gg)	Aviation (Gg)	Marine (Gg)	Total (Gg)	Aviation (Gg)	Marine (Gg)	Total (Gg)
Australia	4 345	2 056	6 401	0.01	0.69	0.70	0.13	0.06	0.19
Austria[a]	890		890	0.00		0.00	0.01		0.01
Belgium	2 370	13 356	15 726						
Bulgaria[b]			162			0.00			0.00
Canada	2 860	2 070	4 920	0.10	0.10	0.10	0.30	0.30	0.60
Czech Republic[c]									
Denmark			4 986			0.00			0.00
Estonia[c]									
Finland			2 800			1.30			1.20
France	7 351	8 136	15 488	0.00	0.00	0.00	0.00	0.26	0.26
Germany	11 589	7 980	19 569	0.20	0.30	0.50	0.20	0.40	0.60
Greece	2 452	7 971	10 423	0.40	0.80	1.20	0.10	0.50	0.60
Hungary[c]									
Iceland			319			0.00			0.00
Ireland			1 172			0.00			0.00
Italy	3 737	8 467	12 204	0.30	0.80	1.10	0.10	0.50	0.60
Japan	13 184	17 621	30 806	0.37	1.31	1.68	0.00	0.37	0.37
Latvia[c]									
Liechtenstein[c]									
Lithuania[c]									
Luxembourg[a]	111		111	0.00		0.00	0.00		0.00
Monaco[d]									
Netherlands	4 500	35 900	40 400						
New Zealand	1 353	1 031	2 384	0.03	0.10	0.13	0.02	0.03	0.05
Norway	510	1 478	1 988	0.00	0.11	0.11	0.02	0.04	0.05
Poland[c]									
Portugal	888	1 173	2 062	0.23	1.86	2.08	0.01	0.03	0.04
Romania[c]									
Russian Federation	2 900	9 500	12 400	0.02	0.63	0.65	0.08	0.08	0.16
Slovakia[d]									
Slovenia[c]									
Spain[e]	5 948	12 076	18 024	1.47	0.55	2.03		0.30	0.30
Sweden	2 045	2 162	4 207	0.10		0.10			
Switzerland[a]	2 160		2 160						
Ukraine[c]									
United Kingdom	14 791	6 559	21 349	2.85	0.60	3.46	0.45	0.42	0.87
United States			83 400						

Note: Estimates of aviation and marine may not add up to the total due to rounding.

[a] Party is landlocked and does not have marine bunkers.
[b] 1990 column contains values for 1988, the base year for Bulgaria.
[c] Party did not provide estimates for international bunker fuels for 1990.
[d] Party did not provide estimates for international bunker fuels, but indicated that emissions were negligible.
[e] Party did not provide estimates for international bunker fuels in 1998 inventory submission. Values are taken from second national communication.

Table 4. Emissions of CO, NO_x, NMVOCs and SO_2 from international bunker fuels, 1990 (Gigagrams)

	CO			NO_x			NMVOCs			SO_2		
	Aviation (Gg)	Marine (Gg)	Total (Gg)	Aviation (Gg)	Marine (Gg)	Total (Gg)	Aviation (Gg)	Marine (Gg)	Total (Gg)	Aviation (Gg)	Marine (Gg)	Total (Gg)
Australia	7.03	1.92	8.95	23.21	54.68	77.90	3.59	1.70	5.29			
Austria[a]	1.54		1.54	4.73		4.73	0.60		0.60	0.29		0.29
Belgium												
Bulgaria[b]			1.80			22.40			0.30			
Canada												
Czech Republic[c]												
Denmark			9.00			85.00			3.00			55.00
Estonia[c]												
Finland						22.00						
France	17.34	2.10	19.44	57.60	154.75	212.35	8.52	70.82	79.34	2.40	150.77	153.17
Germany	56.60	37.30	93.90	50.60	155.30	205.90	9.30	15.20	24.50	3.90	126.30	130.20
Greece	32.50	23.20	55.70	20.40	195.50	215.90	5.80	5.70	11.40	0.80	154.60	155.40
Hungary[c]												
Iceland			0.80			3.20			0.10			0.10
Ireland			2.19			5.35			0.36			
Italy	3.50	20.00	23.50	12.00	194.30	206.30	2.50	5.70	8.20	1.20	131.20	132.40
Japan	22.39	33.59	55.98	54.11	335.86	389.97	3.36	9.70	13.06			
Latvia[c]												
Liechtenstein[c]												
Lithuania[c]												
Luxembourg[a]	0.27		0.27	0.07		0.07	0.09		0.09			
Monaco[d]												
Netherlands												
New Zealand	2.19	2.49	4.67	5.57	24.86	30.43	0.34	0.71	1.05	0.09	9.30	9.39
Norway	1.64	1.44	3.08	1.45	30.26	31.71	0.61	1.11	1.73	0.05	9.90	9.95
Poland[c]												
Portugal	1.72	0.72	2.44	3.51	33.01	36.52	0.03	0.09	0.11			
Romania[c]												
Russian Federation												
Slovakia[d]												
Slovenia[c]												
Spain[e]	9.82	7.19	17.01	23.61	249.26	272.87	0.19	11.24	11.43			
Sweden	3.70	2.50	6.20	4.20	48.00	52.20	0.50	1.00	1.50			
Switzerland[a]												
Ukraine[c]												
United Kingdom	60.06	15.53	75.59	72.79	119.63	192.41	36.87	4.43	41.30	3.76	92.48	96.23
United States												

Note: Estimates of aviation and marine may not add up to the total due to rounding.

[a] Party is landlocked and does not have marine bunkers.
[b] 1990 column contains values for 1988, the base year for Bulgaria.
[c] Party did not provide estimates for international bunker fuels for 1990.
[d] Party did not provide estimates for international bunker fuels, but indicated that emissions were negligible.
[e] Party did not provide estimates for international bunker fuels in 1998 inventory submission. Values are taken from second national communication.

Table 5. Percentage share of CO_2 emissions from international bunker fuels in relation to total CO_2 emissions[a] (excluding emissions from land-use change and forestry), 1990 -1997

	1990 (%)	1991 (%)	1992 (%)	1993 (%)	1994 (%)	1995 (%)	1996 (%)	1997 (%)
Australia	2.3	2.3	2.4	2.5	2.5	2.9	2.9	
Austria[b]	1.4	1.6	1.8	1.8	1.9	1.9	2.1	
Belgium	13.5	13.3	14.1	14.5	13.2	12.8	14.2	
Bulgaria[c]	0.2	1.3	1.5	1.4	1.4	1.4		
Canada	1.1	1.0	1.0	0.9	1.0	1.0	1.0	
Czech Republic							0.3	
Denmark	9.5	7.2	8.1	10.2	10.6	11.9	9.5	
Estonia[d]								
Finland	4.7		5.7	4.7	3.6	3.0	3.2	3.6
France	4.0	3.8	4.1	4.4	4.3	4.4	4.5	
Germany	1.9	1.9	1.9	2.2	2.2	2.2	2.2	
Greece	12.2	11.1	12.2	14.5	14.9	15.3	13.5	
Hungary[b]		0.6	0.6	0.6	0.9	0.9	0.9	
Iceland	14.9	12.6	12.0	12.7	13.6	16.5		
Ireland	3.8	4.2	3.5	4.8	4.1	4.4	4.6	
Italy	2.8				3.0	3.0		
Japan	2.7	2.9	2.9	3.2	3.1	3.1	2.6	
Latvia[d]								
Liechtenstein[d]								
Lithuania[d]								
Luxembourg[e]	0.9				1.6	2.0		
Monaco[e]								
Netherlands	25.0	25.0	25.9	26.6	25.7	25.2	24.8	
New Zealand	9.4	8.5	7.9	8.3	10.2	10.0	8.9	
Norway	5.6	5.3	6.2	6.5	6.4	7.4	7.6	
Poland							0.6	
Portugal	4.4	4.2	4.0	3.7	3.6			
Romania[d]								
Russian Federation	0.5				0.6			
Slovakia[e]								
Slovenia[d]								
Spain[f]	8.0	8.3	8.3	7.9	8.1			
Sweden	7.6	7.8	8.6	8.7	9.2	9.2	7.7	
Switzerland[b]	4.8	4.7	4.9	5.2	5.4	5.5	5.6	
Ukraine[d]								
United Kingdom	3.7	3.6	4.0	4.3	4.4	4.8	5.0	
United States	1.7	1.8	1.8	1.6	1.6	1.7	1.5	

[a] Total CO_2 emissions exclude emissions from international bunker fuels.
[b] Party is landlocked and does not have marine bunkers.
[c] 1990 column contains values for 1988, the base year for Bulgaria.
[d] Party did not provide estimates for international bunker fuels.
[e] Party did not provide estimates for international bunker fuels, but indicated that emissions were negligible.
[f] Party did not provide estimates for international bunker fuels in 1998 inventory submission. Values are taken from second national communication.

Table 6. Domestic and international CO_2 emissions from transport and percentage share of each for selected Parties, 1990

		Domestic	International	Domestic share	International share
		A	B	A/(A+B)*100	B/(A+B)*100
		Gg (CO_2)	Gg (CO_2)	%	%
Australia	aviation	2 555	4 345	37	63
Australia	marine	2 224	2056	52	48
Austria	aviation (1995)	90	1 210	7	93
Belgium	aviation	7	2 370	0.3	99.7
Belgium	marine	378	13 356	3	97
Canada	aviation	10 300	2 860	78	22
Canada	marine	5 720	2 070	73	27
Germany[a]	aviation	2 897	11 589	20	80
Germany	marine	1 396	7 980	15	85
New Zealand	aviation	781	1 353	37	63
New Zealand	marine	221	1 031	18	82
Sweden	aviation	682	2 045	25	75
Sweden	marine	652	2 162	23	77
Switzerland	aviation (1995)	1 245	2 430	34	66

[a] Due to unavailability of data it is assumed that 20 per cent of the emissions are domestic.

Table 7. Trend in total CO_2 emissions[a] and the trend in total CO_2 emissions including international bunker fuels as a percentage of the respective 1990 levels, and difference for the last reported year in percentage points (all estimates excluding land-use change and forestry)

		Percentage relative to 1990, 1990 = 100									
		1990 (Gg)	1991 %	1992 %	1993 %	1994 %	1995 %	1996 %	1997 %	Difference[b] percentage points	
Australia	excl.	275 344	100.6	101.5	102.8	104.2	108.3	112.0		0.7	Australia
	incl.	281 745	100.6	101.5	102.9	104.4	108.9	112.7			
Austria[c]	excl.	62 100	107.6	97.7	96.0	96.6	102.4	104.7		0.7	Austria
	incl.	62 990	107.7	98.1	96.3	97.1	102.9	105.4			
Belgium	excl.	116 090	103.4	101.9	99.8	104.5	104.9	110.7		0.7	Belgium
	incl.	131 816	103.2	102.4	100.6	104.2	104.2	111.4			
Bulgaria[d]	excl.	96 878	68.3	62.1	64.4	61.5	64.2			0.8	Bulgaria
	incl.	97 040	69.1	62.9	65.2	62.2	65.0				
Canada	excl.	460 899	97.9	101.0	101.4	103.5	107.4	110.3		-0.1	Canada
	incl.	465 819	97.9	100.9	101.2	103.3	107.3	110.3			
Czech Republic[e]	excl.	165 490	92.5	84.7	81.5	77.2	77.8	80.1			Czech Republic
	incl.										
Denmark	excl.	52 277	120.4	110.3	113.5	121.2	113.9	140.1		0.0	Denmark
	incl.	57 263	117.8	108.8	114.2	122.4	116.3	140.1			
Estonia[f]	excl.	37 797	97.8	73.5	58.2	60.5	55.2	56.7			Estonia
	incl.										
Finland	excl.	59 200		88.5	89.7	100.1	102.9	112.1	109.1	-1.2	Finland
	incl.	62 000		89.4	89.7	99.0	101.1	110.4	107.9		
France	excl.	390 708	106.8	104.8	99.2	98.9	100.7	104.1		0.5	France
	incl.	406 196	106.6	104.9	99.6	99.2	101.1	104.6			
Germany	excl.	1 014 155	96.2	91.4	90.5	89.2	88.2	89.7		0.2	Germany
	incl.	1 033 724	96.1	91.4	90.8	89.4	88.5	90.0			
Greece	excl.	85 349	99.6	101.9	102.4	104.0	105.8	107.8		1.3	Greece
	incl.	95 772	98.6	101.9	104.6	106.4	108.7	109.0			
Hungary[e,g]	excl.		67 391	89.9	90.3	87.8	88.7	89.7		0.3	Hungary
	incl.		67 767	89.9	90.3	88.1	89.0	90.1			
Iceland	excl.	2 147	96.3	102.3	107.2	105.5	106.3			1.5	Iceland
	incl.	2 466	94.4	99.8	105.2	104.3	107.8				
Ireland	excl.	30 719	103.0	105.4	104.0	108.5	111.1	113.3		0.9	Ireland
	incl.	31 891	103.3	105.0	105.0	108.7	111.7	114.2			
Italy	excl.	432 150				95.4	101.2			0.2	Italy
	incl.	444 354				95.6	101.4				
Japan	excl.	1 124 532	102.1	103.4	101.7	108.0	108.5	109.8		-0.1	Japan
	incl.	1 155 338	102.2	103.6	102.2	108.3	108.8	109.7			
Latvia[f]	excl.	24 771	78.4	66.3	58.5	48.1	48.6	44.7			Latvia
	incl.										
Liechtenstein[f]	excl.	208									Liechtenstein
	incl.										
Lithuania[f]	excl.	39 535									Lithuania
	incl.										
Luxembourg[c]	excl.	12 750				94.1	74.9			0.9	Luxembourg
	incl.	12 861				94.8	75.7				

(continued)

		Percentage relative to 1990, 1990 = 100									
		1990 (Gg)	1991 %	1992 %	1993 %	1994 %	1995 %	1996 %	1997 %	Difference[a] percentage points	
Monaco[b]	excl.	108	115.7	123.1	125.0	127.8	125	130.6			Monaco
	incl.										
Netherlands	excl.	161 360	103.4	102.4	103.8	104.4	109.6	114.6		-0.2	Netherlands
	incl.	201 760	103.4	103.0	105.1	104.9	109.8	114.3			
New Zealand	excl.	25 241	102.2	109.8	107.2	107.3	107.1	114.9		-0.6	New Zealand
	incl.	27 625	101.3	108.3	106.1	108.1	107.7	114.3			
Norway	excl.	35 457	95.3	97.1	101.2	106.5	107.5	115.8		2.2	Norway
	incl.	37 445	95.0	97.6	102.1	107.3	109.4	118.0			
Poland[c]	excl.	476 625		78.0		78.0		78.2			Poland
	incl.										
Portugal	excl.	47 123	103.7	112.5	106.6	107.9				-0.8	Portugal
	incl.	49 185	103.6	112.1	105.9	107.1					
Romania[d]	excl.	194 826	69.6	66.8	65.2	64.5					Romania
	incl.										
Russian Federation	excl.	2 372 300	92.5	84.6	78.2	70.0				0.1	Russian Federation
	incl.	2 384 700				70.0					
Slovakia[e][f]	excl.		50039.0	91.2	87.1	80.7	90.6	92.1			Slovakia
	incl.										
Slovenia[f]	excl.	13 935									Slovenia
	incl.										
Spain[k]	excl.	226 423	100.5	103.8	99.9	104.9				0.1	Spain
	incl.	244 447	100.8	104.1	99.8	105.0					
Sweden	excl.	55 445	99.6	101.0	101.0	105.5	104.8	114.3		0.2	Sweden
	incl.	59 652	99.8	102.0	102.0	107.1	106.4	114.4			
Switzerland[g]	excl.	45 070	103.5	100.8	97.6	96.2	98.0	99.8		0.7	Switzerland
	incl.	47 230	103.4	100.9	97.9	96.7	98.7	100.5			
Ukraine[f]	excl.	700 107									Ukraine
	incl.										
United Kingdom	excl.	583 165	100.7	97.9	95.5	94.9	93.2	96.6		1.2	United Kingdom
	incl.	604 514	100.6	98.2	96.1	95.5	94.3	97.9			
United States	excl.	4 943 300	98.9	100.4	102.8	104.5	105.3	109.1		-0.2	United States
	incl.	5 026 700	99.0	100.5	102.7	104.4	105.2	108.9			

Note: "excl." denotes trend in total CO_2 emissions excluding emissions from international bunker fuels.
"incl." denotes trend in total CO_2 emissions including emissions from international bunker fuels.

[a] Total CO_2 emissions exclude emissions from international bunker fuels.
[b] The difference in trend for the last reported year between emissions including and excluding international bunker fuels. Example Australia: 112.7 per cent (incl.) minus 112.0 per cent (excl.) equals 0.7 percentage points. Differences may occur due to rounding (Canada, Germany, Greece, Hungary, Luxembourg, Netherlands, Russian Federation, Sweden, United Kingdom).
[c] Party is landlocked and does not have marine bunkers.
[d] 1990 column contains values for 1988, the base year for Bulgaria. The percentages are related to the base year 1988.
[e] Party provided estimates for international bunker fuels only for 1996.
[f] Party did not provide estimates for international bunker fuels.
[g] Party did not provide estimates for international bunker fuels for 1990. Absolute values in Gg are given in column for 1991. The percentages in the other columns are related to the year 1991.
[h] Party did not provide estimates for international bunker fuels, but indicated that emissions were negligible.
[i] 1990 column contains value for 1989, the base year for Romania. The percentages are related to the base year 1989.
[j] Party did not provide estimates for 1990 in the 1998 inventory submission. Absolute value in Gg is given in column for 1991. The percentages in the other columns are related to the year 1991.
[k] Party did not provide estimates for international bunker fuels in 1998 inventory submission. Values are taken from second national communication.

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SUBSIDIARY BODY FOR SCIENTIFIC AND TECHNOLOGICAL ADVICE
Tenth session
Bonn, 31 May - 11 June 1999
Item 5 (a) of the provisional agenda

METHODOLOGICAL ISSUES

LAND-USE, LAND-USE CHANGE AND FORESTRY (DECISION 1/CP.3, PARAGRAPH 5 (a))

Report on the second SBSTA workshop on land-use, land-use change and forestry

Note by the secretariat

I. MANDATE

1. The Subsidiary Body for Scientific and Technological Advice (SBSTA), at its ninth session, requested the secretariat to organize a second workshop related to land-use, land-use change and forestry (LULUCF) with the participation of experts, including those engaged in the Intergovernmental Panel on Climate Change (IPCC) process. The purpose of the workshop would be to focus on issues related to Article 3.4 of the Kyoto Protocol, such as methodologies, uncertainties, research and data needs, issues identified in document FCCC/SBSTA/1998/INF.1, and issues derived from submissions by Parties, and to further elaborate on issues arising from the first SBSTA workshop on LULUCF, which was held on 24 and 25 September 1998 in Rome (FCCC/SBSTA/1998/9, para. 34 (c)).

2. It further requested the secretariat to report on the second workshop to the SBSTA at its tenth session.

II. SCOPE

3. In preparing the workshop, account was taken of submissions from Parties,[1] the work of the IPCC in progress on technical and scientific matters associated with Article 3.3 and 3.4 of the Kyoto Protocol, and the agenda of the tenth session of the SBSTA on matters related to those paragraphs of Article 3. Consequently, the workshop focused on:

(a) The status of the IPCC Special Report on LULUCF;

(b) The exchange of information and ideas amongst Parties on methodologies, uncertainties, and research and data needs, and;

(c) Consideration of how scientific and technical information on methodologies, uncertainties, and research and data needs, should be provided to the SBSTA to facilitate discussion on possible additional activities under Article 3.4 of the Kyoto Protocol.

4. Due to the limited time between the workshop and the deadline for the workshop report, annexes I, II and III have not been edited by the secretariat.

III. REPORT ON THE WORKSHOP

5. The workshop was attended by 78 experts nominated by Parties (23 non-Annex I and 55 Annex I Parties), 15 representatives of the environmental, business and industry, and municipalities and local authorities constituencies, 4 expert speakers, and 19 lead authors and coordinating lead authors of the IPCC Special Report on LULUCF.

6. The workshop was co-chaired by Mr. Paul Maclons (South Africa) and Mr. Maciej Sadowski (Poland), who welcomed the participants. Mr. James Lyons, Under Secretary of the United States Department of Agriculture (USDA), welcomed the participants on behalf of the Government of the United States. Mr. Dennis Tirpak, Deputy Coordinator, UNFCCC secretariat, gave an overview of the issue within the Convention/intergovernmental process and possible decision-making in this regard (see FCCC/SBSTA/1999/5).

7. Dr. Robert Watson, Chairman of the IPCC, gave a progress report on the IPCC Special Report on LULUCF. The coordinating lead authors of the Special Report provided details on chapters two to seven, followed by question-and-answer sessions. The presentations focused on the process by which the chapters are being put together, the structure of the chapters, the scope and the key issues. Summaries of these presentations are contained in annex I.

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[1] Submissions regarding issues to be considered at the second SBSTA workshop, together with submissions on the first sentence of Article 3.4 of the Kyoto Protocol, and on policy and procedural issues associated with Article 3.3 and 3.4 of the Kyoto Protocol, are contained in document FCCC/SBSTA/1999/MISC.2 and its addendum.

8. Fourteen experts nominated by Parties[2] made presentations on topics such as methodological issues associated with additional activities under Article 3.4 of the Kyoto Protocol, including: carbon contents and fluxes in agricultural soils, experience with inventories of forests and other woody biomass, sustainable land and forest management, restoration of degraded land, and measurement uncertainties. Summaries of these presentations are contained in annex II.

9. After these presentations the group split into breakout groups dealing with issues associated with the agricultural sector (approximately 25 participants) and the forestry sector (approximately 75 participants).[3] Presentations were made by four experts focusing on some aspects of methodological issues, uncertainties, and research and data needs, for different activities which may be considered under Article 3.4. of the Kyoto Protocol. After these presentations the workshop participants considered a common question using a "case study" approach. The question posed was: How should scientific and technical information on methodologies, uncertainties, research and data needs, be provided to the SBSTA to facilitate consideration of possible additional activities under Article 3.4 of the Kyoto Protocol?

10. The breakout groups were requested to prepare a simple, short but comprehensive report and to provide the information to the plenary on the last morning of the workshop. A synthesis of these reports is contained in the next section, whilst the full reports of the breakout groups are contained in annex III.

11. The co-chairmen noted that some of the provisions of Article 3.3 and 3.4 of the Kyoto Protocol are unclear and need further discussion, and that even after the completion of the IPCC Special Report, some gaps in our understanding may remain. This will need to be overcome before this article of the Kyoto Protocol can be implemented smoothly and with confidence. They also encouraged Parties to continue to develop and implement national systems for the estimation of carbon stocks and changes to those stocks.

12. The co-chairmen closed the workshop with a special word of thanks to the Governments of Japan and the United States of America for their financial assistance to the workshop, particularly to the United States Department of Agriculture for helping with logistical arrangements for the workshop. In addition, they expressed appreciation to Dr. Robert Watson, the lead authors and the coordinating lead authors of the Special Report who made presentations.

13. Following the workshop, the United States Department of Agriculture organized a field trip to a farm site where low tillage agricultural practices have been used for approximately 20 years. The field trip also included a visit to an experimental forest site where measurements are

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[2] Presentations were made by experts nominated by the following Parties: Argentina, Australia, Austria, Canada, Estonia, Finland, Iceland, Italy, Japan, Norway, Slovenia, Sweden, Switzerland, and the United States of America.

[3] The coordinating lead authors and lead authors of the IPCC Special Report could not participate in these breakout groups as they had to attend a lead authors' meeting.

being made of carbon dioxide, other gases, and forest biomass, in order to estimate the amoun carbon being stored in, and released from forest.

IV. SYNTHESIS OF SUBGROUP REPORTS TO THE PLENARY

14. The reports of the breakout groups revealed a number of common issues, suggesting a consensus on their importance. These include tentative *conclusions* as follows:

(a) It would be useful if the IPCC could use a unified format for the presentation o information on the activities/categories that are to be discussed in the Special Report on LULUCF. A suggestion was made that the exact format could be developed in consultation w the secretariat;

(b) Additional activities under Article 3.4 should be in conformity with other conventions such as the Convention to Combat Desertification, the Convention on Biological Diversity, and the Forest Principles contained in Agenda 21, and;

(c) Reporting on Article 3.3 and 3.4 activities during the first commitment period should include both the emissions from, and the removal by, those activities. In addition, Part should work towards comprehensive reporting on all activities/categories during the second commitment period, possibly before.

15. In addition, other *questions* were identified that could be addressed by the IPCC and/o Parties. These were:

(a) What are the implication of defining activities/categories broadly or narrowly? For example, would defining activities/categories narrowly lead to a "lock-in" of technology?

(b) What are the implications of approving additional activities under Article 3.4 o the Kyoto Protocol for the targets of all Parties to the Protocol in the first and subsequent commitment periods?

(c) What information should be provided on the models that are used by Parties to quantify carbon stocks and changes to those stocks? How can these models be evaluated?

(d) Should guidance on "best practices" for the purpose of developing monitoring systems be provided? If so, how and when should this guidance be developed?

16. In addition, the breakout groups made *suggestions* as to what the SBSTA might wish t consider during its tenth session, for example:

(a) Request the IPCC to present more detailed information on each chapter to raise awareness of the type and level of information that is likely to be forthcoming in the Special Report on LULUCF;

(b) Further discuss the treatment of wood products in national accounting systems in the light of the approaches evaluated by the IPCC;[4]

(c) Discuss criteria for selecting additional activities under Article 3.4 of the Kyoto Protocol;

(d) Consider a process for further decision-making on issues related to LULUCF.

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[4] IPCC/OECD/IEA Programme on National Greenhouse Gas Inventories: "Evaluating Approaches for Estimating Net Emissions of Carbon Dioxide from Forest Harvesting and Wood Products" by Sandra Brown, Bo Lim, and Bernhard Schlamadinger. Meeting report, Dakar, Senegal, 5-7 May 1998.

Annex I[1]

SUMMARY OF PRESENTATIONS ON THE IPCC SPECIAL REPORT ON LAND-USE, LAND-USE CHANGE AND FORESTRY

The IPCC Special Report on Land-Use, Land-Use Change and Forestry (SR-LUCF) examines carbon stocks and flows in terrestrial ecosystems in the agricultural and forestry sectors. It addresses scientific and technical issues, and other matters of importance for implementing the Framework Convention on Climate Change and the Kyoto Protocol, that are designed to stabilize atmospheric concentrations of greenhouse gases. The final report will be policy relevant, yet policy neutral with the understanding that sovereign nations will determine how best to implement carbon sequestration programs.

At the Subsidiary Body for Scientific and Technological Advice workshop in Indianapolis, key issues were discussed by the workshop participants such as: uncertainties, methodologies, and research and data needs in relation to carbon sequestration, carbon accounting, definitions, verifiability, and the permanence of carbon sinks. The Special Report addresses each of these concerns, as well as others, such as socio-economic and additional environmental impacts of different activities that can be undertaken in the agricultural and forestry sector. This report may serve as a guidebook of the tools available for assessing and monitoring carbon stocks and flows in these sectors.

Chapter 2:

Chapter 2 of the report describes carbon system dynamics in relation to the transfer of carbon from the atmospheric to the terrestrial reservoir of above-ground biomass and soils and vice versa. This chapter provides the background to the report dealing with key considerations in this area such as: what are the daily, seasonal, and annual variations in global carbon stocks and flows? How have these changed in the last 20 years as evidenced by a new assessment for the decade 1988-1998? What are the long-term natural and anthropogenic trends in atmospheric and terrestrial carbon pools?

Chapter 3:

Chapter 3 of the SR-LUCF is the "definitions chapter", recognizing appropriate definitions as the basis for viable carbon sequestration strategies. The chapter outlines the principles and criteria employed to suggest definitional scenarios that are sufficiently flexible to fit a variety of real-world situations. The chapter also reviews existing definitions and their adequacy for these purposes.

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[1] The information in this annex was provided by the IPCC. The text has not been edited by the secretariat.

The chapter reviews the selected definitional scenarios and the application of language specific to the Kyoto Protocol, such as: human-induced, direct, activities, projects, and project activities, resulting from, related to, since 1990, changes in carbon stocks in each commitment period, verifiable and transparent. It also reviews the linkages and interaction between definitions, addresses leakage and issues such as carbon accounting and appropriate levels of accounting and reporting. The chapter also includes a review of methods for the measurement of stocks, fluxes, and harvested wood products.

Chapter 4:

Chapter 4 focuses on Article 3.3 of the Protocol. It builds upon the foundation of definitions developed in the previous chapter to quantify changes in carbon stocks resulting from afforestation, reforestation, and deforestation (ARD) activities. A critical issue is the choice of definitions that determine the extent of land that is included in the accounting system. Detailed scenarios for each of the ARD activities are developed for forestry that evaluate the magnitude and timing of changes in carbon pools. This chapter also contains a detailed discussion of the trade-offs and uncertainties, in terms of carbon, between intended outcomes and simplicity of accounting.

The chapter continues to assess the definitional scenarios and their impact on reported carbon stock changes (as compared to the real carbon stock changes) for hypothetical ARD case studies on the stand and landscape levels. It summarizes published country studies to demonstrate the range of carbon implications for various scenarios, and assesses the magnitude of carbon credits or debits ARD activities might create at the global scale. Finally, the chapter identifies, for each definitional scenario, the interactions of increased ARD activities with biodiversity, water cycle, socio-economic, and other considerations.

Chapter 5:

Chapter 5 focuses on scientific and technical information related to the most widely-discussed "additional activities" that will be considered as the Conference of the Parties (COP) makes its decisions on activities that can be included under Article 3.4. Such practices are presented with regards to the process and timescale of carbon changes.

Some of the important issues to be addressed include the definitional and boundary questions: where does one land use end and the adjoining one begin? How readily can those questions be answered using existing scientific and technical methods? If the final COP decision is to include a partial list of land use, land-use change, and forestry activities, those definitions become critical, because each definition will mean that millions of hectares may be defined in or out of the party's carbon accounting system. A full accounting system, on the other hand, makes definitions far less critical because all lands will be in one category or another, and all will be reported. This will, however, create the need for a broader inventory and data system, which may create challenges for the Parties.

In addition, the chapter will examine issues such as transparency, verifiability and uncertainties, and how those will be affected by various options for including "additional activities", and the consideration of the uncertainties for evaluating carbon sequestration in carbon pools susceptible to disruption by natural and anthropogenic forces and events.

Chapter 6:

Chapter 6 addresses project based activities that include one or more mitigation activities within a specific geographic location, time and institutional frame at a sub-national level. In this chapter, timing and time preferences associated with their greenhouse gas (GHG) mitigation, and permanence, risks, additionality, accounting and leakage of GHG benefits are examined. Furthermore, three alternative approaches to account for GHG flows, in order to address the permanence issue are presented. Establishing without-project baselines and additionality of GHG flows is the most challenging issue facing projects. In that context approaches such as modeling and trend analysis are discussed.

Most nations employ techniques and methods for measuring carbon pools in land-use, land-use change and forestry projects that are based on accepted principles of forest inventory, ecological surveys, and soil science. This chapter considers these factors and suggest how standard criteria might be used to quantify and verify carbon sequestration. This last point underscores the importance of technology transfer and human and institutional capacity-building to improve national capabilities for carbon sequestration project design and implementation.

Chapter 7:

The Special Report concludes with a discussion of adequacy of the Revised 1996 IPCC Guidelines for operationalizing the Kyoto Protocol. These guidelines represent the current state of international consensus on methods for reporting the impacts of greenhouse gas emissions and removals. There are several aspects of the guidelines, however, that do not specifically address the issues surrounding changes in carbon stock. Consequently, chapter 7 will assess discrepancies between current guidelines and provisions required under Article 3 of the Kyoto Protocol and provide suggestions for relevant guidelines to account for changes of carbon stock both at the project and national level. These suggestions will highlight the issues to be considered in such reporting guidelines.

Annex II[1]

SUMMARIES OF PRESENTATIONS BY PARTIES

Name of Presenter : Mr. Daniel Maradei (Argentina)

Title of Presentation : Why forestry in Argentina?

Summary of Presentation :

There is an outstanding potential for investments in the Argentine forestry sector, based on:

1. Availability of large land areas with high production potential with private ownership rights.
2. Very competitive land cost, when compared to land costs of neighbouring countries.
3. Relatively low plantation establishment costs.
4. Availability of a highly qualified labour force.
5. Climate diversity that allows growth of a wide variety of species.
6. Absence of economically important insect or disease problems
7. High growth rates which allow for greater wood production with shorter rotations (5 to 7 years for eucalypts and 16 to 22 years for pines).
8. Promotional measures offered by Federal and Provincial Governments.
9. Economic deregulation and fiscal stability.
10. Very attractive returns on investments.

Finally, Argentina has some clear advantages for obtaining Clean Development Mechanisms (CDM) investments in Land-Use Change and Forestry (LUCF) projects.

An essential thing to be considered -even though the CDM does not explicitly refer to the improvement of sinks- is that LUCF unquestionably results in emission reductions. LUCF has a very important advantage over the energy sector, which is that while changes in energy can only result in a reduction of emissions, LUCF can reduce emissions through improved management and increase natural carbon sequestration in sinks.

Options for emissions reduction in LUCF include avoiding deforestation, preventing forest fires, using residues for production method efficiency, improving forest management, using low impact shoring up techniques, etc.

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[1] The information in this annex was provided by the presenters. The text has not been edited by the secretariat.

Name of Presenter : Mr. Ian Carruthers (Australia)

Title of Presentation : Additional activities under Article 3.4

Summary of Presentation :

Land based activities are a major feature in Australia's greenhouse profile.

Additional activities under Article 3.4 present opportunities to move to a more comprehensive greenhouse response by including land based activities which simultaneously provide important sustainable development benefits.

Australia has a comprehensive response strategy, the National Greenhouse Strategy. A National Carbon Accounting System is under development to provide a comprehensive framework for measurement monitoring and verification.

Many potential sustainable land management which have greenhouse benefits, for example use of saltbush and oil-mallee plantings in areas of dryland salinity and improved grazing management practices in Australia's extensive rangelands, lie outside the scope of afforestation and reforestation under Article 3.3 of the Protocol.

Name of Presenter : Mr. Klaus Radunsky (Austria)

Title of Presentation : First estimation of sinks according to Article 3.3 of the Kyoto Protocol and recalculation of sector "changes in forest and other woody biomass stocks".

Summary of Presentation :

Austrian forest inventory is an adequate basis to estimate sinks according to Article 3.3. This Kyoto forest has been calculated to be a net source until 2020 and only becomes a sinks afterwards. A recalculation of the sector "changes in forest and other woody biomass stocks" shows that extrapolation of data of previous forest inventory resulted in an over estimation of th Austrian forest of about 100%.

Name of Presenter : Dr. C. Wayne Lindwall (Canada)

Title of Presentation : Measurement and verification of soil carbon sinks - Challenges and opportunities

Summary of Presentation :

Soil scientists have been measuring soil carbon changes as affected by land management practices for more than 100 years. The adoption of more sustainable land practices such as conservation tillage and extended crop rotations can result in soil carbon gains of 0.2 to 0.4 t/yr for 20 to 25 years. A pilot project has been initiated to determine the feasibility of measuring and verifying soil carbon changes over a 3-5 year period on representative prairie landscapes. Proposed national verification should include representative soil benchmark databases, carbon process models, land use information and various remote sensing applications. In addition to reducing emissions and enhancing sinks, soil C sequestration has the universal benefits of improved soil and water conservation, soil quality and productivity and consistent with the principles of sustainable land management.

Name of Presenter : Mr. Juri Truusa (Estonia)

Title of Presentation : Land-use, land-use change and forestry in Estonia : Overview

Summary of Presentation :

Estonia is a small (45 th.km^2) state with growing economy (average GDP + 4-6 % 1995 - 1998). Structure of landuse:- 67% forest, 26% arable land, 6% natural grassland. Volume of growing stock is almost doubled since 1980's (1997 - 295 mln m^3) annual increment more than 9 mln m^3 yearly, gross felling is rised from 1.3 mln m^3 on the end of 80's to 5.6 mln m^3 on the end of 90's. Estonia's platform to Kyoto UNFCCC is in conjunction with the EU targets.

Name of Presenter: : Mr. Heikki Granholm (Finland)

Title of Presentation : Changes in forest and other woody biomass stocks.

Summary of Presentation :

The role of forests as carbon sinks and reservoirs can be best ensured through sustainable forest management:

(a) Through protection and enhancement of existing carbon stocks,
(b) Through establishment of new carbon stocks, and

(c) By encouraging the use of renewable biomass and wood-based products to fossil fuels and fossil fuel-based products.

In the presentation, changes in forest and other woody biomass stocks accounting was pu forward for further consideration. In order to make changes in forest and other woody bi stocks accounting sink an operational sink calculation method, a possibility of determini common discount factor in which total forest carbon stock change might be credited to c

A brief comparison of individual and detailed activity-based approach and the changes in and other woody biomass stocks accounting method.

Name of Presenter : Olafur Arnalds (Iceland)

Title of Presentation : Organic carbon sequestering by restoration of sever degraded areas in Iceland

Summary of Presentation :

1) Carbon in soils is very important in relation to the FCCC.
2) Excluding soil carbon as sink activity puts unfair bias on areas with favou conditions for tree growth.
3) Exceeding the soil component gives wrong picture of carbon balance of f systems (sometimes huge errors).
4) Icelandic research shows that carbon sequestration in relation to restoratio severely degraded areas can be quantified and verified.
5) Such additional activity provided incentives for actions important for sust development, and the goals of the CCD and the biodiversity conventions.
6) Iceland provided a special report on designated actions for sequestering c relation to restoration of severely degraded lands.

Name of Presenter : Mr. Lorenzo Ciccarese (Italy)

Title of Presentation : Human-induced activities related to the forest secto Italy and impact on carbon budget

Summary of Presentation :

A refinement in carbon budget evaluation under the IPCC methodology and its adaptatio incorporate new human-induced activities have remarkable effects on the carbon sink-so balance of Italy's forest sector. A more precise evaluation of carbon storage might bring the need to reconsider the role of the forest sector in a country level net carbon balance.

reconsideration of some human-induced activities will bring about a more complete economic recognition of the important positive functions of the forest resources.

Name of Presenter : Mr. Masahiro Amano (Japan)

Title of Presentation : Discussions on implications of the Kyoto Protocol, Article 3.4 in the Japan case.

Summary of Presentation :

There are several alternative definitions for the fundamental concepts relevant to the Land Use Change and Forestry Sector. This report is to discuss alternative definitions and their merits and demerits through the Japan case. The Kyoto Forest (ARD) in Japan will be a carbon source under the definition of ARD which is defined with land use changes, IPCC interpretation. On the other hand, the Kyoto Forest in Japan will be a carbon sink under the definition with land cover changes, FAO interpretation. Almost all forests are classified into managed forests in Japan. If the Article 3.4 may include managed forests as additional human induced activities, the amount of carbon sequestrated into Japanese Forest Sector will count for 10 times comparing to forests limited to ARD, Article 3.3 forests. But it is not fair to take account of all forests without regard to the difference of forest area per capita, because the amount of carbon gained by total forests is strongly related to the forest area per capita of each country.

Name of Presenter : Mr. Audun Rosland (Norway)

Title of Presentation : CO_2 sinks in Norway and methodologicai issues to additional human-induced activities

Summary of Presentation :

The IPCC Special Report on LUCF should be the main basis for decisions on definitions and rules on the inclusion of activities under both Article 3.3 and 3.4 of the Kyoto Protocol. Inclusion of new activities under Article 3.4 should give credit to countries that endeavour to maintain and support sustainable forest management and forest biodiversity.

For the second and subsequent commitment periods it is Norways general view that we should aim for a full carbon stock account, prerequisite that sufficient estimation methodology has been developed. An inclusion of full carbon stock account may necessitate new and more differentiated commitments for the Parties. For the first commitment period - however - it is important that harvesting and other forest management activities are limited to those forest areas defined under Article 3.3. (that is limited to "since 1990").

Activities that would change the net CO_2 sink in soil should be included, as long as the stock change can be measured in a verifiable way. However, guidelines and rules on activities related to soil carbon should take into account that the stock change processes are highly dependent on temperature, latitude, altitude and vegetation cover.

In Norway and in other countries in the Boreal forest area, the "Kyoto forest" as it is defined under Article 3.3., could be a carbon source rather than a sink, while the "real forest" is a large sink, for the case of Norway, even with an increasing yearly net sink. The last 10 years the total forest area in Norway has been a sink of 10-18 million tonnes of CO_2 every year. This is equivalent to about 40% of the total CO_2 emissions from fossil fuel etc. in Norway.

Estimations done in Norway show that the amount of carbon stored in wood products is significantly less than in forests, approximately 0.5 million tonnes per year. Storage in buildings is the most important carbon reservoir for wood products. The uncertainty of the estimates is larger than +/- 50%.

The "dead" carbon content in soil is probably approximately 5 times higher than in the "living" biomass in the forests. A very rough estimate of yearly accumulation in soil is 3 million tonnes of CO_2. (the uncertainty is probably one order of magnitude). Higher temperature could reduce the carbon content.

Fresh waters and estuaries also represent carbon sinks in Norway.

Name of Presenter : Mr. Aleksander Golob (Slovenia)

Title of Presentation : Influence of sustainable forest management on carbon storage in Slovenia

Summary of Presentation :

Long tradition of sustainable forestry and forest management planning (1771). Since the 19th century, forest area has risen from 36% to 55% today, growing stock has more than doubled. Forestry policy promotes close-to-nature forestry aiming at higher growing stock; shelterwood instead of clear-cutting.

Forest management planning in all forests since 1961 provide for reliable data concerning carbon storage in above-ground biomass (permanent sample plots).
Slovenia supports full accounting system. Some flexibility in methodology should be allowed provided that relevant documentation exists. Forest management practices should be taken into account for assessing changes in below-ground biomass pool.

Name of Presenter : Mr. Mats Olsson (Sweden)

Title of Presentation : Uncertainties in measurements of carbon stocks in forest soils - effects of silvicultural measures

Summary of Presentation :

The soil is actively contributing to the carbon fluxes and its inclusion in Article 3.3 and 3.4 is a logical and important step. It may presently be difficult in most cases to include soil carbon in a verifiable and transparent manner due to lack of precise instruments for measurements and follow-up. Any decision taken should however not exclude the possibilities of a future inclusion of soil carbon stocks. It is particularly important that soil carbon stocks are considered when forest management is expected to cause negative spill-over effects that counteract greenhouse gas mitigation.

Name of Presenter : Mr. Daniel Perruchoud (Switzerland)

Title of Presentation : Assessing regional changes of carbon stocks in forest soils.

Summary of Presentation :

Soil organic carbon (SOC) represents a substantial carbon sinks in naturally regrowing forests of Western Europe adding between 30-50% to the forest tree carbon sink at present.
Given the high SOC variability and the slow response of SOC to environmental changes, depletion or accretion of SOC is unlikely to be detected by conventional soil monitoring at regional scale.

Current SOC accumulation in European forests represent a transcend effect and will be reversed if litter inputs decrease in response to land-use change or if microbial respiration is enhanced in a warmer world.

Name of Presenter : Mr. Michael Jawson and Mr. Richard Birdsey (USA)

Title of Presentation : Article 3.4: Potential framework for land-use management activities

Summary of Presentation :

- Proposed a system of complete carbon accounting on all managed lands.

- Broadly defined management activities (e.g., cropland, grassland, forest land) including land-use, land cover and land management offer the greatest production flexibility while:

- counting sources and sinks associated with a wide range of practices.
- ensuring all production practices and lands are included.
- providing incentives for innovation.

- A system of research (basic, process studies and long-term field experiments), and inv
and databases and modelling (process driven) provides a repeatable, verifiable and
comprehensive accounting of changes in carbon stocks in the agricultural and forest poo

Annex III[1]

I. REPORT OF SUB-GROUP ON AGRICULTURE

After two expert presentations, the working group proceeded to explore the information necessary for the selection of additional activities under Article 3.4. It was considered useful if IPCC could evaluate the implications of selecting broadly defined activities versus narrowly defined activities for the issues listed below.

Priority issues

The group identified the following as priority issues SBSTA would need to have information on in order to make an informed decision on inclusion of additional activities:

What verifiable changes in carbon stocks and the exchanges of other GHG would result from the activity for each Party in Annex B? This would require estimation of rates of removals or emissions from the activity and the area potentially available for the activity.

Are the changes in carbon stocks human induced?

How permanent are the changes in carbon stocks?

What are the associated uncertainties?

Does the activity contribute to meeting the objective of other environmental agreements?

The IPCC Special Report will address all of these issues. Additional information from Parties will also be required, in particular on no. 1.

Other relevant issues

The group also considered following issues of relevance to this process. Some of these relate directly to the priority issues listed above. For many of these, information is needed on the availability of tools and methods for the determination of these aspects.

Data needs and availability

Data needed to select activities to be added under Article 3.4.
Data needed to report on an activity and to verify the changes in carbon stocks
What? Where? Level of detail? Major gaps?
Data on impacts on emissions of other GHG

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[1] The information in this annex was provided by the presenters. The text has not been edited by the secretariat.

Monitoring
- Methodology
- Transparency

Additionality
- Baseline determination

Attribution
- To human impact
  - Direct or indirect?
  - Since 1990 or pre-1990?
- To natural processes

Ancillary costs and benefits
- Biodiversity
- Environmental services
- Direct impacts on emission
- Desertification

Leakage
- Ensuring net benefits

Temporal dynamics of changes in carbon stocks
- Permanence
- Changes in rates with time (including changes in sign)

Economic factors and incentives
- Cost of implementation
- Cost of verification and reporting

Driving forces and motivations
- Leading to the implementation of the activity
- Leading to negative effects (such as land degradation)

Vulnerability to climate change

Information from IPCC and Parties

The group agreed that a unified format for the presentation of information on activities in the IPCC report would be useful. This exact format would be developed in consultation with the UNFCCC secretariat.

It was also agreed that it might be useful to request from Parties initial estimates of changes in carbon stocks resulting from activities and on the availability of data to underpin decisions by SBSTA.

II. REPORT OF SUB-GROUP I ON FORESTRY

OVERARCHING CONTEXT ISSUES

- Consistency with objectives of the FCCC
- 1st commitment period
  Framework - Gross/limited Net
  since 1990 (Kyoto Forest)
  changes in carbon stocks
- 2nd and subsequent commitment period
  Target framework may be different
  Since 1990 may not apply
  Consistency with move to more comprehensive accounting

"ACTIVITIES" KEPT IN MIND

- Changes in forests and other woody biomass stocks
- Forest Management Activities - some examples
  thinning
  changes in ?standing stock? due to changes in rotation length
  reduced impact logging
  activities that cause degradation

CRITERIA (details inside brackets are issues/questions felt to be relevant)

1. Consistency with the Kyoto Protocol including links within the Protocol.
   1st commitment period
   2nd and subsequent periods

(implications for target; expansion i.e. to future full accounting; permanence; anthropogenic vs human induced; transparency; clarity i.e. single clear definitions; co-benefits; risks i.e. fires, pests and diseases, severe storms, informal harvesting)

2. Based on sound science - inventory data, also social and economic science

(data availability, accuracy, verifiability; consistency with & availability of current methodologies; scale i.e. magnitude; scale independence i.e. local, regional, national, between countries; transparency; expansion i.e. to future full accounting; practicability; cost effectiveness including social costs; clarity i.e. single clear definitions; anthropogenic vs human induced; risks i.e. fires, pests and diseases, severe storms, informal harvesting)

3. Promote other environmental and social objectives

(scale independence i.e. local, regional, national, between countries; appropriate incentives i.e. positive not perverse; expansion i.e. to future full accounting; leakage; practicability; cost effectiveness including social costs; sink potential; consistency with other conventions CBD,CCD,RAMSAR; risks i.e. fires, pests and diseases, severe storms, informal harvesting)

4. Symmetry in the treatment of both sources and sinks
(appropriate incentives i.e. positive not perverse; expansion i.e. to future full accounting; transparency; links/interaction with 3.3 activities; leakage)

5. Promote objectives of the FCCC
(appropriate incentives i.e. positive not perverse; expansion i.e. to future full accounting; permane scale, i.e. magnitude; cost effectiveness including social costs; co-benefits; consistency with othe conventions CBD,CCD,RAMSAR)

PROCESS AND TIMING ISSUES

Short term
1st Commitment Period
COP 6 decisions
1st sentence of Article 3.4
IPCC Special Report
Necessary SBSTA parallel process
Demonstrable progress (Art 3.2) by 2005 - e.g. what necessary re Articles 5 & 7

Medium term
2nd Commitment Period
2005 or earlier - beginning negotiations
IPCC SR
IPCC TAR
Necessary SBSTA process

WHAT WOULD WE LIKE TO DO AT SBSTA 10?

- Policy and Procedural Issues
  - Compilation of submissions
  - Paper by the secretariat - way forward?
- Side bar workshops to discuss sinks issues further - i.e. move to next level of detail coming out of this workshop. (Also a desire for more a detailed workshop later, also in conjunction an IPCC lead authors meeting).
- Presentations on Key Issues identified in this and the Rome workshop - by Parties? - Expert
- More detailed verbal and written report from the IPCC, e.g. detailed Chapter Outlines

ISSUES RELATED TO THE IPCC SPECIAL REPORT

- Need for data - i.e., magnitude of sink for specific "activities"?
  - aggregate Annex B
  - country/region specific

- Clarity / clarification regarding "activities" is required
  - e.g. individual "human-induced" activities such as thinning from
  - changes in stocks in forests (regarded as an activity in IPCC Guidelines)

- Harvested wood products
  - if no, or minimal, more than Dakar report SBSTA needs to take up this issue as soon as possible.

III. REPORT OF SUB-GROUP II ON FORESTRY

METHODOLOGY		
Criteria	Forest Management	Natural Regeneration
Can "human-induced" be distinguished	Does it need to be "active" management?	Is abandonment "human induced"? Could it be driven by indirect policies?
Can terms be consistently defined	How is conservation/ preservation treated? Wood products? Below ground carbon?	Is used to define a regeneration practice and to define natural land use reversion from agriculture to forest. Is this covered in Article 3.3?
Uncertainties	Broader activity defn. will have lower uncertainty. Greater number of plots to assess trends. Above ground carbon better.	Lower confidence. Can natural regeneration be distinguished from planting?
Consistency with IPCC guidelines	Yes	Could be.
Data and methods availability	Generally available for Annex I countries. Not all. Methods not always comparable.	Depends on the country. Could be improved easily.
Since 1990	Does this require a change in management since 1990, or all forest management since 1990?	Can be determined from the age of the stand. Might be difficult in cases of natural succession.
Measurability	Yes. Could be compared with atmospheric measurements.	Yes. Lower confidence.
Research and development needs	Monitoring and data collection. Statistical design. Soil carbon. Wood products.	How useful is this activity as a sink.

CHARACTERISTICS		
Criteria	Forest Management	Natural Regeneration
Ease/clarity of definitions	Since 1990 could cause problems. All activities or just the changes since 1990.	All natural regeneration or just natural succession?
Symmetry	Captures sources and sinks	Primarily a sink. Depending on the baseline from which the activity is compared against.
Permanence and reversibility -- internal or external to system?	internal to forest management -- other land uses in or out?	Depends on if the comparable sources are added.
Potential for "perverse" incentives	Could exist if the commitment periods are not contiguous.	Could exist if the commitment periods are not contiguous.
Positive and negative externalities	Broad range of positive and potentially negative externalities. More positive.	Loss of agriculture lands. Increased biodiversity. Extension of forest area.
Leakage	broader category reduces leakage. Could exist if other land management activities are not included.	Narrower activity could result in greater leakage.
"lock-in of technology	No. Under a broad definition of forest management.	Includes a specific class of management/regeneration techniques
Incentives for good forest practices	General. Specific actions are not promoted.	Could be used to target specific actions to sequester carbon.
MAGNITUDE		
Criteria	Forest Management	Natural Regeneration
Applicable land base	Large	Smaller
Technical potential	Large	Smaller
Baselines (?)	Additional or all activities? Can baselines be calculated?	Additional or all activities? Can baselines be calculated. This could be difficult for natural regeneration.
National data	How will this affect national targets?	How will this affect national targets?

TIMING Criteria	Forest Management	Natural Regeneration
When do benefits accrue?	Intermediate stand management can produce benefits more quickly than planting	Natural regeneration produces carbon benefits more slowly than other more active management.
How long before system for assessment can be established?	Will depend on how the system is defined and the similarities with current national inventory systems.	Will depend on how the system is defined and the similarities with current national inventory systems.
Delay between investment and benefits	Yes	Yes

IV. REPORT OF SUB-GROUP III ON FORESTRY

Starting point:

- Selection of "human induced activities" as indicated by Article 3.4; and scope of definition
- Broad: ("activity") (forest management area)
  Narrow: ("practices") (thinning, felling, fertilize, drainage,...)
- Bound area for consideration by: "direct human induced" activity, and by "measurable and verifiable".

Goal:

- "Comprehensive C accounting and GHG response in forest sub sector".

Strategy:

- Decide on process of additional forest management practices (from Article 3.3)
  (Could be a series of decisions...).

Questions to be examined in decision making on additional activities:

Characterization of additional land based activities

1. State of knowledge and understanding of mechanisms (summary):
   - how do the processes work
   - dynamics of carbon pools and forest system

2. Amount of carbon involved: global, regional, national level.

Measuring carbon and other GHGs

1. Measurement and verification

2. Data availability

3. Cost of monitoring, and implications for data quality

4. Which carbon pools:
   - Data quality?
   - Data availability?
   - Which are key pools for carbon accounting
   - Soil depth and horizons

5. Information on models used which describe
   - Assess direct human impacts on C
   - Peer reviewed?
   - Documentation
   - In IPCC Special Report
   - In national reporting

6. Data:
   - Estimates measurable? Verifiable?
   - Models - link to data and activity
   - Reviewed
   - Transparency
   - IPCC identify potential to get data, and time data could be expected (first second?). Address capacity of Parties to provide data/estimates
   - "Best practices guidance" for carbon estimation, selection and use of met

Implication of carbon storage

1. Lifetimes of carbon pools: comparability with emissions of other GHGs and sec
   - Risk and permanence
   - Different timeframes and lifetimes for carbon pools and carbon systems
   - Managing risk
   - Risk: example:
     - Natural (variability, El nino, global change)
     - Social and institutional
     - Technical

2. Implications for Sustainable development, including:
   - Biodiversity
   - Desertification
   - Sustainable forest management
   - Soil and water quality

3. Impact on other GHGs
   - Spillover effects.

Future developments and needs

1. Further research needs

2. Further data needs

3. SBSTA request for:
   - Additional data in 3rd National communications to supplement analysis in

- Parties to begin monitoring for future needs.

Policy issues/areas

1. How to distinguish between activities before and after 1990?
2. Human induced vs. natural activity determination
3. Does "direct human induced" refer to the C or to the activity on the land?
4. Direct vs. indirect effect? Attribution of C stock changes
5. Period before 2008? Event points?
6. Treatment of fires: set or natural, on managed or unmanaged land?
7. Similarly, insects and treat or not
8. Tons and targets?
9. Gross/net vs. net/net.